February 20, 2012

California Coastal Commission
San Francisco, CA

Subject: Request for revocation of the Coastal Development Permit (CDP) for the Los Osos Wastewater Project (LOWWP) (See *Request for Revocation of the LOWWP CDP*.)

Honorable Commissioners:

Attached is our Request for Revocation of the Los Osos Wastewater Project (LOWWP) Coastal Development Permit (CDP). This cover letter provides an overview of the issues covered by the Request, including why we are submitting the Request and why the Commission should revoke the LOWWP permit. Basically, the information we present shows the LOWWP could have disastrous adverse consequences on the Los Osos area, including the water basin and vital sensitive habitat, and agencies intentionally provided inaccurate, erroneous, and incomplete information that failed to disclose these impacts. Additionally, the evidence we provide shows agencies substantially exaggerated the benefits of the project and failed to disclose that a much less harmful, feasible alternative is available. As you know, the Los Osos Basin is a threatened resource, on which many vital systems rely. Water and wastewater decisions must be based on the best possible accurate and complete information.

Basis for revocation request and why we must submit it

The LOSG received the email from Mr. Carl on January 23, 2012, stating the criteria we must meet for a successful revocation request. We are sure our request meets that criteria and the Commission will see that 1) the County and CCRWQCB withheld information or intentionally provided inaccurate or erroneous information prior to June 2010, 2) the information was crucial to decision making and could have led to denial of the project or changed conditions, and 3) the LOSG has done due diligence as citizens to get the information to the Commission as soon as possible given the complexity of issues, size of the record, intentional withholding of information, and necessity for the issue to be addressed comprehensively. (Also see LOSG letter to the Coastal Commission dated January 26, 2012, pp. 10 & 11 and Section IV.E of the Request for Revocation for further evidence of due diligence.)

A comprehensive picture of issues, in the case of Los Osos, is necessary to show why a large body of evidence on the record supporting the project no longer constitutes substantial evidence. A complete presentation of issues is also needed to show how and why very serious potential adverse impacts remain unmitigated, why the project could do more harm than good (and cannot not be conditioned to protect resources), and why a management alternative is the least harmful feasible alternative. Finally, a comprehensive picture is needed to show why a process driven by Resolution 83-13 is inherently flawed and has led to a project that will harm resources.

We are sure the Commission will see that the issues are too important not to address. This project could have extremely serious adverse consequences on the Los Osos Valley Water Basin, the sole source of water for the area already threatened by an extremely urgent seawater intrusion problem. It could have severe adverse impacts on very high value sensitive habitat, including Morro Bay National Estuary and Los Osos Creek endangered steelhead habitat. It could also have severe adverse consequences on the lives of many people now and in the future, on air quality, and climate change. The Commission approved the project on the basis that it is "critically necessary" to protect these resources, based on County and CCRWQCB official statements and documents. However, the information we present shows that information is not accurate, and the project could severely harm those resources.

As citizens in possession of this information, we have no choice but to present it as soon as possible in the effort to prevent severe harm to resources. If agencies cannot show with specific evidence that septic systems are a significant source of pollution of the estuary and pose a significant threat to health and safety, that the project will stop that pollution and threat and is essential for basin sustainability, and that the severe potential adverse impacts we identify are mitigated with specific, measureable, enforceable--and feasible measures--then the permit should be revoked. This is what the County and CCRWQCB information claims, yet it is not supported by the information we located in the record. The decision to allow this project to go forward must be based on facts and an unbiased analysis of facts using the most relevant, complete, and accurate information available. This project has the potential to destroy a water basin, vital habitat, and a community. The decision to allow this project to go forward cannot be based on popular opinion, political expediency, or on information that might otherwise fail to meet Coastal Commission standards for accurate and complete information or CEQA standards for substantial evidence.

The information the County and CCRWQCB provided to the Commission claims that septic systems are causing significant harm to resources and the LOWWP will stop that harm, it is needed for basin sustainability, and it is least harmful feasible alternative. The information we provide shows that County officials knew the following prior to approval of the project on June 11, 2010.

- Septic systems are not significantly polluting the estuary or related habitat, and the project will not provide a significant benefit to these resources.
- The project provides no significant benefits to the basin and is not needed for basin sustainability.
- The project has severe unmitigated potential adverse impacts on key resources: 1) the Los Osos groundwater basin, 2) very high value environmentally sensitive habitat (ESHA), 3) human health and safety, and 4) air quality (GHGs), for which feasible mitigation is unlikely.

Some of the most serious unmitigated potential impacts not disclosed include the following:

- Severe impacts from earthquakes due to liquefaction under homes downhill from the Broderson disposal site that could result in loss of life, major property damage, and long-term shut down of the wastewater system.
- Substantial adverse impacts to the upper aquifer (significant drops in water levels, seawater intrusion, reduced beneficial use, and adverse impacts to protected aquatic habitat), resulting from two issues: a delay of 2 to 14 years or more between the time septic system return flows stop recharging the upper aquifer (dispersed vertical recharge) and the time Broderson leach fields (centralized lateral recharge) restore water levels and replace flows (assuming Broderson disposal is feasible and works as planned). This impact is substantially increased by the adverse cumulative effects of major shifts in pumping to the upper aquifer, which water purveyors are currently planning to address the urgent seawater intrusion problem.
- Substantial adverse impacts to all aquifers and habitat from conservation and recycled water programs that provide little if any mitigation. The CDP provides for a conservation and recycled water program to back up to Broderson disposal and add a margin of safety. However, agencies overstated the mitigation potential of both of these measures and failed to disclose adverse impacts. By June 2010, a considerable amount of conservation had already occurred in Los Osos greatly reducing or eliminating the potential for conservation to mitigate for the project. Also, agencies knew the recycled water program would not offset pumping of the lower aquifer significantly (so would not significantly mitigate for seawater intrusion), and they knew the high salt content the water could destroy soils and aquifers, also resulting in underuse of the program and/or the need for additional mitigation and facilities. The SWRCB has required a "feasibility study" for the recycled water program. However, a "study" after the fact does not mitigate for impacts or ensure feasibility. The CDP includes the recycled water program as a main mitigation measure for seawater intrusion and habitat, yet it has undisclosed, unmitigated potential adverse impacts on the basin, habitat, farmland, and farming aquifers.
- Substantial unmitigated adverse impacts, including indirect and cumulative impacts, on the lower aquifer that could make the extremely urgent seawater intrusion problem worse. Purveyors have not come to an agreement on how to manage the basin to stop seawater intrusion and will not likely come to an agreement or make necessary investments to shift pumping to the upper aquifer realizing that the project will have major impacts on the basin. For example, they know the project has significant unmitigated impacts on the upper aquifer, and they know recycled water will be high in salts. They will not commit resources to the recycled water program or shifts in

pumping to the upper aquifer if these measures put investments at risk (although experts agree urgent major shifts in pumping to the upper aquifer are needed to address seawater intrusion). The project also has unmitigated socio-economic impacts on these resources. The project will delay or prevent necessary water management measures, future mitigations, and major system repairs (e.g., due to earthquakes) because these essential measures will not be affordable to rate payers.

- Substantial unmitigated impacts on Los Osos Creek, endangered steelhead habitat, resulting from a reduction in groundwater flows that could reduce flows in the creek and increase contaminant levels by reducing the size and viability of buffering wetlands (e.g., Willow Creek Drainage). The project includes extensive mitigation for a possible minor drop in water levels in the creek as a pipe is installed over the creek, but ignores this much more serious impact.

These are some of the unmitigated impacts that we identify and explain in our Request for Revocation. The information we provide shows that County and CCRWQCB withheld information necessary for the Commission to recognize that the project has severe unmitigated impacts, provides no significant benefits on the estuary and basin, and will do more harm than good. The evidence we provide also shows these agencies withheld information showing a less-harmful, feasible alternative exists. A comprehensive management program, similar to the plan in effect for the San Lorenzo River Watershed will do everything officials claim this project will do, and much more, at a fraction of the cost. The CCRWQCB also has jurisdiction over the San Lorenzo Watershed.

Why information provided by the CCRWCB should be considered in this request

Although the County is the CDP applicant and lead agency under CEQA, your decision to grant the permit, according to the CDP Staff Report of May 27, 2010, is based on the finding that State and Regional Water Boards are requiring the Los Osos project. Further, the Commission relied, to a large extent, on information provided to you by the CCRWQCB for findings that resulted in the approval of the project. Much of that information is inaccurate, erroneous, or incomplete. Although the Commission's authority is limited when reviewing a treatment works, the Commission does have the right and responsibility to expect and ensure the information provided to you by agencies is accurate and complete, in order to make the best decision possible. It has become clear to us, based on the evidence we provide, that, while the CCRWQCB and SWRCB are requiring the project, the agencies are not committed to project mitigation or basin sustainability.

Why Resolution 83-13 must not drive decision making and should be rescinded

Resolution 83-13 is driving the implementation of a centralized wastewater project for the prohibition zone of Los Osos, but Resolution 83-13 is not based on substantial evidence in the record. Most of the key findings supporting Resolution 83-13 have been refuted or no longer apply. CEQA precludes inclusion of inaccurate information as substantial evidence. So long as the effort to solve the water quality and supply issues in Los Osos begin and end with Resolution 83-13, Los Osos resources will be at risk. We've provided a discussion of Resolution 83-13 in our request so the Commission, including why and how Resolution 83-13 has resulted in a flawed environmental review process and project that will harm resources.

Los Osos should not be subjected to a project and process controlled by an obsolete regulation. Resolution 83-13 was implemented in 1983 under very different conditions, and current science contradicts most of its findings. In 1983, seawater intrusion was not a concern and decision makers believed they could resort to imported water if a centralized wastewater project caused seawater intrusion or buildout proved unsustainable. The realities of the 21st Century are much different—evidence supports that the carrying capacity of the basin has been reached and additional building is unsustainable. Thus, a centralized project—conceived and designed to allow buildout—should not be implemented. It will only increase growth pressures at the same time it causes a major disruption to a water basin already under stress from accelerating seawater intrusion moving through the large lower aquifers--9/10ths of total basin capacity—at 700 feet per year. Los Osos should not be held captive to decisions made in the 20th Century, which threaten resource substantially in the 21st Century. **Therefore we are asking you to use your authority to have Resolution 83-13 rescinded**.

How this project drives unsustainable growth

As our members of the LOSG have pointed out in the past, this project drives unsustainable growth by being so expensive that property owners and public officials will support more growth just to have the costs reduced. This is one way the County is promoting more growth. Recently, we've heard the County is preparing a Habitat Conservation Plan (HCP) and applying for a "Sustainable Community" grant for a "study" of sustainable water supplies. This "study" will undoubtedly find that there is enough water in the basin for build out. To support this finding, the study will undoubtedly provide "proof" in the form of a hydrological study that relies on modeling. In the 1980s and 1990s, rather than limit growth, the County relied on revised models, which "proved" the basin could sustain more growth—and 20 years later we have a critical seawater intrusion problem. It is time to stop this cycle

of resource overuse in Los Osos. We do not have the luxury in the 21st Century to sponsor growth at the expense of resources, nor do we have the luxury to install a $190 million wastewater project whose only verifiable benefit is to allow building, both of which set Los Osos on a course toward disaster.

How the Request for Revocation is organized

Our request for revocation entitled *Request for Revocation of the LOWWP CDP* is divided into for parts:

Part I: **"**Agencies intentionally provided the Commission inaccurate and incomplete information that would have required additional or different conditions or denial of the permit." [Violation of Coastal Commission Administrative Regulation 14 CCR § 13105 (a)]

Part II. The project's adverse impacts and risks far outweigh its benefits.

Part III. "Property owners adversely affected by the project were not notified and given a chance to comment." [Violation of Coastal Commission Administrative Regulation 14 CCR § 13105 (b)]

Part IV. "The Commission failed to comply with the Coastal Act and CEQA due to inaccurate, erroneous, or incomplete information. (The CCRWQCB and SWRCB also violated CEQA.)

(Please also see "Outline of Request" and previous related letters/emails attached or on disc.)

If our Request for Revocation is denied, we ask that the Commission provide specific reasons and the specific evidence (documents) used as the basis for the decision. Again, we regret any inaccuracies or inconsistencies in our request. We have done the best we can to cover the issues within a timeframe that avoids harm to resources. If Commissioners or Commission Staff notice errors or inconsistencies, we request that they are pointed out. We will clarify or correct them.

We thank for your consideration of these important issues.

Keith Wimer Elaine Watson Larry Raio Chuck Cesena

LOSG

Request for Revocation of the Los Osos Wastewater Project (LOWWP) Coastal Development Permit (CDP)

(LOSG, February 20, 2012--with March 1, 2012 revisions)

Grounds for Revocation

Part I. Agencies intentionally provided the Commission inaccurate, erroneous, and incomplete information that would have required additional or different conditions or denial of the permit.

I.A Violation overview

Coastal Commission Administrative Regulation 14 CCR § 13105, "Grounds for Revocation," Subsection (a) states:

Grounds for revocation of a permit shall be:

(a) Intentional inclusion of inaccurate, erroneous or incomplete information in connection with a coastal development permit application, where the commission finds that accurate and complete information would have caused the commission to require additional or different conditions on a permit or deny an application;

The County of San Luis Obispo (County) and Central Coast Regional Water Quality Control Board (CCRWQCB) intentionally provided inaccurate, erroneous, or incomplete information to the Coastal Commission prior to approval of a Coastal Development Permit (CDP) for the Los Osos Wastewater Project (LOWWP) in June of 2010. The inclusion of inaccurate, erroneous, or incomplete information, in violation of Administration Regulation 14 CCR § 13105 (a), resulted in approval of a CDP for the LOWWP, even though the project has substantial unmitigated potential adverse impacts on the vital coastal resources it is supposed to protect. These resources include the Los Osos Valley Water Basin (the sole source of water for the Los Osos area), very high value environmentally sensitive habitat, including Morro Bay National Estuary and Los Osos Creek (endangered steelhead habitat), and public health and safety (including the potential for significant loss of life and property damage from unmitigated earthquake impacts). The project will also have substantial unavoidable adverse impacts on sensitive habitat, air quality/climate change, and non-renewable resources. Because the County and CCRWQCB intentionally provided inaccurate, erroneous, incomplete information, the Commission failed to recognize that the project has severe unmitigated impacts and will do more harm than good to the resources it is meant to protect, as well as other vital resources, also failing to recognize that a much less harmful, feasible alternative is available.

Pursuant to the California Coastal Act and CEQA the Commission must deny approval of a project if its impacts have not been addressed, and it must deny a project if a less harmful feasible alternative is available. Had the Commission received accurate and complete information, the Commission would have recognized the above facts and reasonably denied the permit for the project. Therefore, pursuant to Coastal Commission Administrative Regulation 14 CCR § 13105 (a) the Commission should revoke the project's Coastal Development Permit.

I.B. Flawed findings in the Staff Report of May 27, 2010, based on inaccurate, erroneous, or incomplete information.

Based in findings in the Commission Staff Report of May 27, 2010, the Commission approved the project on the basis that the project is "critically" and urgently necessary to protect and preserve the Morro Bay National Estuary and related sensitive habitat, the Los Osos Valley Water basin (community water supply), and public health and safety--and would greatly enhance these resources. However, accurate and complete information shows the LOWWP provides no significant benefits to these resources, and instead causes severe potential adverse impacts to these resources. These adverse impacts include further degradation and destruction of the water basin by the extremely serious seawater intrusion problem, and destruction of sensitive habitat by a substantial reduction in groundwater flows, which could reduce stream flows in Los Osos Creek (endangered steelhead habitat) and reduce the size and viability of wetlands that buffer and protect surface waters, including the National Estuary, from polluted runoff. Further, the project has severe unmitigated cumulative and socio-economic impacts that substantially increase the potential adverse impacts of the project. The very high cost of the project ($150 to more than $350 per month per home owner) will make future project mitigations, including adaptive management, major system repairs from earthquakes, and essential resource protection programs, including water supply and storm water management programs, unaffordable for property owners. Los Osos is located in an earthquake zone near faults capable of a severe earthquake, and much of the area has highly liquefiable soils. Similar conditions in Fukishima, Japan and Christchurch, New Zealand led to catastrophic consequences. Because the project continues to have severe unmitigated adverse impacts on the Los Osos water basin—the sole source of water for the area—it could even result in adverse impacts to the resources of other California communities by forcing Los Osos to resort to imported water. Moreover, the project results in permanent loss of eight acres of environmentally sensitive habitat, 400,000 gallons of fossil fuel consumption, and 14,000 tons of GHG emissions, among other certain adverse impacts.

The Commission approved the project, despite its considerable unavoidable adverse impacts, on the basis that it is critically and urgently needed to protect Morro Bay National Estuary, Los Osos Valley Water Basin and other resources. The County and CCRWQCB further asserted that the $190 million project is essential for water basin and community sustainability. However, these assertions are not accurate; they are part of the inaccurate, erroneous, and incomplete information the Commission received from the County and CCRWQCB in their effort to have the Commission approve the project.

The evidence we provide, which agencies intentionally withheld, shows the project does not provide a significant benefit to these vital, resources while putting the resources at risk. The evidence further shows a comprehensive basin management alternative, with integrated septic system and nitrate management, storm water management, and conservation, in conjunction with planned water purveyor actions, will achieve project benefits (reduce contamination—primarily nitrates), also providing substantially greater environmental benefits, at a fraction of the cost of the approved project with virtually none the adverse impacts or risks.

I.B.1. Flawed findings in the CDP Staff Report of May 27, 2010.

The following pages from the CDP Staff Report of May 27, 2010, present some of the flawed findings, on which the Commission based a decision to approve the LOWWP. These findings assert that the project is critically and urgently necessary to protect and preserve resources, and the project is the least harmful feasible alternative. However, the findings are inaccurate as a result of inaccurate, erroneous, and incomplete information provided by the County and CCRWQCB, which substantially and intentionally exaggerated the potential benefits of the project, while failing to disclose severe adverse potential impacts and less harmful feasible alternatives.

> *Although there may be potential for incremental refinements to the project through continued, more specific analysis, this potential must be weighed against the long-standing need to take action as soon as possible to protect water quality in Los Osos, including sensitive wetland, riparian, and groundwater resources* (Emphasis added) (Cited Document 1, p. 3)

> *As conditioned, staff believes that there is no feasible, less-environmentally damaging wastewater treatment project, including with respect to plant siting, and with respect to collection and effluent disposal methodologies and siting, as required by the LCP. In addition, the project has been conceived and designed to maximize the productive reuse of the effluent in the Los Osos basin, and to help improve groundwater health and sustainability. In short, the project as conditioned is a much needed and well-conceived beneficial coastal resource project that is essential to protect ground and surface waters in and near Los Osos, including the Morro Bay National Estuary and related habitats and resources, and to provide essential public services to the Los Osos area. … The resultant project represents an important environmental enhancement project of statewide importance that will greatly improve environmental health and safety associated with ground and surface water in and around Los Osos, including in Morro Bay, and including with respect to its related habitat resources. The project does entail certain impacts, but it is hard to conceive of a treatment project at this scale for this area that would not have such impacts.* (Emphasis added) (Cited Document 1, pp. 7 & 8)

> *As discussed previously, in addition to addressing contamination of the groundwater drinking water supply of Los Osos, a major part of the need for the LOWWP is to address pollution of environmentally sensitive coastal waters in and around Los Osos. In fact, the project is best characterized as a large scale environmental remediation and improvement effort that has been critically necessary for many years, and its*

implementation should result in significant resource enhancement and protection for a particularly sensitive series of resources, including the Morro Bay Estuary itself. To the extent the project will address long-standing water pollution issues, the Commission finds that the project is consistent with the LCP's requirements to protect and enhance ESHA and coastal waters (Emphasis added) (Cited Document 1, pp. 29 & 30).

Notwithstanding its overall benefit to sensitive resources, there will be some direct and adverse impacts to ESHA and sensitive wetland resources due to the project construction. These include impacts at the treatment plant site, the Broderson disposal site, various pump stations associated with the collection system, and a staging area, as well as potential impacts to surface resources from changes to hydrology…

…The Commission's Staff ecologist has visited the Broderson site, and consistent with prior Commission analyses and findings related to Broderson, has concluded that the site is entirely ESHA, most of it very high quality:

> *… siting a wastewater treatment project in Los Osos outside of ESHA is likely impossible. As indicated above, my understanding is that the LCP allows for some ESHA disturbance for such a project provided it is the least environmentally damaging feasible alternative. Within this context, the County has examined various options for pump station, leach field, and staging area locations, and has made extensive efforts to identify the least environmentally damaging alternatives…*(Emphasis added) (Cited Document 1, p. 32)

Despite the benefits to coastal water quality and the marine habitats of the Morro Bay National Estuary offered by the proposed replacement of septic systems with a wastewater treatment plant, some impacts to water quality can be anticipated. Fortunately, water quality impacts can be resolved by applying special conditions to the permit approval. Some of the special conditions are new, while other build on and improve existing County conditions. Only with these special conditions is the project consistent with the LCP's water quality protection standards. (Emphasis added) (Cited Document 1, pp. 70 & 71)

Concerns have also been raised that the project will result in harmful discharges to Morro Bay and the Los Osos groundwater basins due to incomplete removal of harmful substances; the disposal system will adversely impact drinking water supplies; the project will not adequately remove salts, carcinogens, pharmaceuticals, endocrine disruptors, and other pollutants and will therefore not achieve a safe or sustainable source of potable water; and the project poses human health risks. However, concerns regarding the plant's ability to effectively remove harmful substances from wastewater, and dispose of the treated effluent and sludge in a manner that protects human health and safety, are issues addressed by RWQCB waste discharge requirements and Department of Health Services regulations.

Further, the primary reason for the project is to reduce harmful discharges to Morro Bay and the Los Osos groundwater basins. In fact, the RWQCB has determined that construction and operation of the proposed facility is necessary to protect and restore the water quality of the Los Osos groundwater basin and the Morro Bay National Estuary. (Emphasis added) (Emphasis added) (Cited Document 1, pp. 72 & 73)

I.B.2. Statements by Jonna D. Engel, Ph.D., Coastal Commission Ecologist (Memorandum dated May 19, 2010)

The following statement by Jonna D. Engel, Ph.D. clearly shows Dr. Engel would not have recommended the loss of 8.75 acres of ESHA had the CCRWQCB not provided information indicating that a wastewater project was necessary to stop long-term and significant pollution of Morro Bay National Estuary, in order to "protect and restore" the resource.

The primary reason for the Los Osos Wastewater Treatment Project is to reduce harmful discharges to Morro Bay and the Los Osos groundwater basins (sic). The Regional Water Quality Control Board (RWQCB) has determined that a wastewater treatment project is necessary to protect and restore the water quality of the Los Osos groundwater basin and the Morro Bay National Estuary…The current design for the proposed Los Osos Wastewater Treatment Project is intended to address and resolve this significant and longstanding environmental degradation issue, and its importance should not be underestimated… the project includes unavoidable habitat impacts, including leach field installation at the Broderson site and pump station development throughout Los Osos. I believe that the County has appropriately limited such impacts through thoughtful siting and design, but they are impacts nonetheless. The County has calculated a total of 8.75 acres as the areal extent of these impacts…I do not recommend a particular mitigation ratio because all of the project area is essentially ESHA (Emphasis added) (Cited Document 2, Exhibit 6, pp. 11 & 12.)

I.C. Evidence the Commission cites to support flawed findings based on Inaccurate, erroneous or incomplete information provided by the County and CCRWQCB.

I.C.1. Overview: The Commission Staff Report of May 27, 2010, makes inaccurate findings based on the evidence cited below. The evidence states or implies the following.

1. Groundwater seeps and flooding septic systems in Los Osos are significantly polluting the National Estuary and related sensitive habitat, causing restrictions on recreational use and shellfish harvesting, and posing significant threats to public health and safety.

2. Nitrate contamination from septic systems is causing significant and increasing degradation of the water supply (basin), threats to health and safety, and the project is essential for basin sustainability.

However, these statements/implications are not accurate as shown by the evidence we provide in Section I.E.1. below.

I.C.2. Statements from the Staff Report of May 27, 2010

Beginning in the early 1970's, the RWQCB and other health agencies began to raise environmental health and safety concerns regarding the use of septic systems in Los Osos. In particular, the depth to groundwater in Los Osos was determined to be shallow enough in some areas to lead to inadequately treated septic discharges into ground and surface water, including due to flooding of leach fields in wet weather, leading to environmental degradation,[7] including to adjacent Morro Bay (from both surface flow and lateral seepage of inadequately treated septic discharge) and to groundwater resources more generally,[8] groundwater contamination issues were and are compounded by the fact that the Los Osos area obtains its potable water supply from local groundwater aquifers…

The RWQCB took a series of steps to address these concerns, beginning with adopting an interim Basin Plan in 1971 that included a provision prohibiting septic system discharges in much of Los Osos after 1974. In 1983, the RWQCB subsequently determined that the situation was worsening, and adopted a wastewater discharge prohibition for a portion of the Los Osos area known as the Prohibition Zone (see Exhibit 1), finding as follows:[9]

- *Previous studies (Brown and Caldwell, 1983) indicated that the quality of water derived from the shallow aquifer underlying the community was deteriorating, particularly as it relates to increasing concentrations of nitrates in excess of State standards.*

- *The current method of wastewater disposal by individual septic tank systems located in areas of high groundwater may be a major contributing factor to this degradation of water quality. And,*

- *Continuation of this method of waste disposal could result in health hazards to the community and the continued degradation of groundwater quality in violation of the Porter-Cologne Act*

In 1988, the RWQCB also established a discharge moratorium that effectively halted all new construction and all major expansions of existing development until a solution to the septic tank pollution problem could be developed and implemented. Even so, the identified problems have continued. More recently, the RWQCB indicated as follows in 1998:

> *Monitoring data indicates much of the shallow groundwater in the most densely developed areas exceeds 45 mg/l, the drinking water standard for nitrate. For this reason, many of the shallow water supply wells have been removed from service and demand shifted to the deeper aquifer. Dependence on the deeper aquifer*

exacerbates the surface water problems because the community's water supply, formerly from the upper aquifer, is now drawn from the deeper aquifer and recharged (after use) to the upper aquifer causing groundwater levels to rise and flood more septic systems. Increasing surface water impacts including: restriction of portions of shellfish harvesting areas because of rising bacteria levels; waters around the Los Osos area periodically do not meet bacteria standards for water contact recreation (such as swimming, wading, kayaking and small boat sailing); and the public is increasingly exposed to surface wastewater

There have been a series of attempts to address the identified ground and surface water pollution issues in Los Osos through construction and operation of a wastewater project … (Emphasis added) (Cited Document 1, pp. 10-12.)

2. Water Quality Analysis

The LCP includes a suite of policies and ordinances designed to protect coastal water quality. A major reason for the LOWWP is to resolve longstanding impacts associated with septic seepage polluting the groundwater basin and area surface waters. As described, the RWQCB and other health agencies became concerned with the use of individual septic/disposal systems in the early 1970's when it was identified that the depth to groundwater is shallow enough in some areas of Los Osos to flood leach fields in wet weather. Surface flow and lateral seepage of inadequately treated wastewater posed adverse impacts to Morro Bay. Significant concerns were also raised regarding the impacts of septic systems on groundwater resources, particularly because the Los Osos area obtains its water supply from groundwater aquifers. In 1988, the RWQCB established a discharge moratorium that effectively halted all new construction and all major expansions of existing development until a solution to the septic tank pollution problem could be developed and implemented. In 1995, a study issued by the RWQCB titled "Assessment of Nitrate Contamination in Ground Water Basins of the Central Coast Region Preliminary Working Draft", highlighted significant increases in nitrate concentrations in both the lower and upper aquifers. According to a letter from the RWQCB on July 10, 1998 regarding the study. (See cited paragraph from the 1998 CCRWQCB letter on previous page.)

According to the RWQCB, in areas where depth to groundwater is shallow, many of the seepage pits discharge directly into the upper aquifer with no separation. Contaminated groundwater sometimes reaches the surface, especially during the rainy season. In a 2002 support document for Morro Bay regarding total maximum daily load for pathogens (including Chorro and Los Osos Creeks) the RWQCB indicated that elevated levels of fecal coliform were present in Morro Bay and that other pollutants such as bacterial, viral, or cyst forming pathogens may also be present. According to the same report, portions of the commercial oyster beds in Morro Bay have been closed for harvest by the California Department of Health Services per the United States Food and Drug Administration's National Shellfish Sanitation Program standards because of high fecal coliform levels. Based

on the levels of fecal coliform, seasonal restrictions have been imposed on commercial shellfish harvesting in other portions of Morro Bay; however, no restrictions are in place on non-commercial shellfish harvesting related to fecal coliform levels (CRWQCB 2002). This information prompted further action to address the issue of groundwater contamination as well as possible impacts to surface water resources around the Los Osos area. (Emphasis added) (See Cited Document 1, pp. 70 & 71.)

Evidence in the possession of the County and CCRWQCB prior to issuance of the May 27, 2010 Staff Report, which was intentionally withheld, confirms that septic systems do not cause shell fish harvesting restrictions or measurable pollution of Morro Bay National Estuary and related habitat, or threats to the basin water supply and public health and safety. (See Section I.E.1.)

I.D. Additional inaccurate, erroneous, or incomplete information the County and CCRWQCB provided to the Commission.

I.D.1. Overview: The testimony and/or letters of County and CCRWQCB officials, including Supervisor Bruce Gibson and CCRWQCB Executive Director Roger Briggs, provided further inaccurate, erroneous, or incomplete information to the Commission, stating or implying septic systems cause significant harm to the estuary, the basin, and/or public health and safety, and the wastewater project is needed to remove that "threat." The information fails to disclose severe potential adverse impacts from the project, or that less harmful, feasible alternatives are available, and it states or implies inaccurately that the wastewater project is essential for basin sustainability. The importance of these claims to the Commission's decision to approve the project is shown in a statement by Jonathon Bishop, the Commission Staff member who presented the project on June 11, 2010. (See Section I.D.4. below.)

I.D.2. Statement by County Supervisor Bruce Gibson at the January 2011 Coastal Commission hearing:

We've had 30 years of groundwater pollution to the Los Osos ground water basin and that has got to stop. We've had over 30 years of pollution to the Morro Bay National Estuary. That has got to stop and I think most commissioners sitting today are familiar with that estuary. In 2007 we took a field trip out of Morro Bay and you saw firsthand the abundant and dramatic wildlife that exists both in and adjacent to that remarkable body of water. We have a project here that not only stops that pollution that I referenced but it goes several steps beyond correcting the consequences of that pollution which is the seawater intrusion that we've referenced. … And now we respectfully ask for your concurrence on that matter (to find no substantial issue) and

act to prevent an environmental disaster so we can act to protect the health of the community of Los Osos." (Emphasis added) (See Cited Document 4; also see video of January 14, 2010, hearing on the Coastal Commission website.)

I.D.3. Statements by Roger Briggs, Executive Director of the CCRWQCB, in a letter to the Commission.

In order for the Los Osos watershed to be restored to a healthy state, both its groundwater and surface waters (including the Morro Bay National Estuary) need to be protected and improved. These waters have been damaged by various water and wastewater practices and are currently far from being sustainable. Seawater is intruding the lower groundwater aquifer due to overdraft conditions in the basin. Septic systems are destroying a vital and valuable portion of the upper aquifer systems. Bacteria is seeping into the estuary at high concentrations. During wet weather conditions, septic system effluent surfaces

The County's proposed wastewater project is a vital piece of the groundwater basin management puzzle and will be a giant step toward returning the groundwater basin's sustainability… While this project is expensive and a financial burden for the system users, its relative cost will diminish as the true value of water continues to evolve upward in this water-short groundwater basin, region, and state. Users cannot afford to continue non-sustainable practices in the Los Osos groundwater basin, where groundwater is the only source of water for now and the foreseeable future and where a nationally recognized estuary needs to be better protected. (Emphasis added) (See Cited Document 5, pp. 1&2 of appended letter dated September 25, 2009.)

I.D.4. Statements by Jonathon Bishop at the June 2010 hearing.

The following statement by Jonathon Bishop, the Coastal Commission Staff member who presented the project on June 11, 2010, hearing, confirms that Staff's recommendation to approve the project resulted from CCRWQCB input:

We want to focus your attention on a letter from the Water Quality Control Board. It's on pg.103 of your addendum packet of materials and in that letter the Regional Board asserts that this project is a vital and necessary step toward water quality improvement and groundwater protection. Staff concurs and our recommendation makes findings that this is a critical project for the protection of coastal water quality and in this overall

respect is consistent with LCP requirements to protect surface and groundwater in Los Osos.

The above evidence shows that Commission Staff recommended approval of the project CDP, with conditions, based on the comments, letters, and/or other information provided by the County and CCRWQCB. The evidence we provide in **Section I.E.1**. below shows that the information was inaccurate, erroneous, or incomplete.

I.D.5. Evidence provided in other sections of this Request shows that inaccurate, erroneous, or incomplete information intentionally provided by the County and CCRWQCB led to the Commission's approval of the LOWWP although the project has severe unmitigated impacts. Evidence provided in **Section I.E.2.** below shows the County and CCRWQCB failed to provide accurate and complete information regarding the project's potential adverse impacts and proposed mitigation measures. This led to the Commission's approval of a project with substantial unmitigated adverse impacts on: 1) the water basin (Zones A-E), 2) Morro Bay National Estuary and related sensitive aquatic habitat, including wetlands and Los Osos Creek, and 3) public health and safety (including the potential for loss of life and substantial property damage from unmitigated earthquake impacts). Some of the evidence we provide also shows mitigation is not likely to be feasible.

I.E. Accurate and complete information agencies intentionally withheld.

I.E.1. Evidence that septic systems do not threaten Morro Bay National Estuary, related habitat, the basin, or public health and safety—and the project is not needed for basin sustainability. (A comprehensive management plan would achieve project goals and basin sustainability with far fewer impacts and risks at a fraction of the cost).

I.E.1.a. *The EIR does not state or show the project will benefit the estuary, is essential for basin sustainability, or is critically necessary to protect public health and safety.*

The DEIR does not include a project objective to improve water quality in the estuary or related habitat, nor does it claim the project will benefit these environmental resources. (See Cited Document 6, pp. 2-6 to 2-8, and 3-8, and Cited Document 7.) It further does not claim that the project is "critically" or urgently needed to protect the public health and establish basin sustainability, as shown by the project goals and objectives:

> *3.1.2 - Project Goals and Objectives*
> *The primary goal of the LOWWP is to construct and operate a community wastewater collection, treatment and disposal system and, thereby, comply with the RWQCB's WDR Resolution 83-13. Eliminating discharges from onsite wastewater, as directed by the*

RWQCB, will also help accomplish the LOWWP's second primary goal: alleviating groundwater contamination, primarily nitrates, that has occurred at least partially because of the use of septic systems throughout the community.

One of the wastewater project's secondary objectives involves water resources issues. Water resources issues are important because of seawater intrusion that is contaminating the Los Osos groundwater basin. On March 27, 2007, the County Board of Supervisors certified a "level (sic) of Severity (LOS) III for the community of Los Osos while adopting a Resource Capacity Study of the Los Osos groundwater basin. The LOS III determination is the highest determination of a resource problem under the County's Resource Management System. The wastewater project can be an important first step to solving water resource problems. While the primary purpose of the Los Osos Wastewater Project is to construct a community wastewater system and, thereby, to alleviate groundwater contamination, how that goal is met can create or hinder opportunities for the water purveyors to improve the local water resources. (Emphasis added) (See Cited Document 6, p. 3-8, and Cited Document 7)

The DEIR "Groundwater Quality Analysis" (Appendix D), when describing the project's potential nitrate reduction benefit, provides further evidence the EIR did not present the project as critically or urgently needed for basin sustainability or public health and safety:

*The slow turnover rate of groundwater has been identified as the single most important basin characteristic affecting water-quality trends in the Los Osos Basin (*Cited Document 34.*) This occurs because the volume of groundwater in storage is relatively large compared to annual inflows and outflows. The result is that any action to decrease nitrogen loading (i.e., the LOWWP) will take a relatively long time to have an effect. As a result, nitrate concentrations in some deep wells may continue to increase for many years before the effect of septage removal reaches the lower aquifer system. Recent study has concluded that the shallow aquifer system may take on the order of three decades to equilibrate to a change in nitrate loading (*Cited Document 34.*) Regardless of the time frame required to realize a reduction in nitrate concentrations across the Los Osos Basin this impact is considered a beneficial impact to the basin* (Emphasis added) ("Preliminary Hydrogeological Impact Study," Hopkins Groundwater Consultants, Inc., Appendix D-2, p. 34.) (See Cited Document 8, and Cited Document 9.)

The above statements show that the authors of the EIR, and the experts the County hired to assist with the EIR, did not find sufficient evidence to assert that the project would benefit the estuary and/or is critically and urgently necessary to protect the basin and public health and safety. Given that such claims provide the basis for Resolution 83-13 and AB 2701, which provide the CCRWQCB and County the authority to pursue the project, and given that lead and responsible agencies are required to

independently review and guarantee the accuracy of EIRs; it is reasonable to conclude that County and CCRWQCB officials (also SWRCB officials) knew prior to the June 2010 Commission hearing that the EIR failed to support claims that the project significantly benefited the estuary or basin. This fact, and the following facts, provide substantial evidence County and CCRWQCB officials intentionally provided inaccurate, erroneous, or incomplete information, which misrepresented the potential benefits and adverse impacts of the project.

I.E.1.b. Pathogens from Los Osos septic systems do not threaten the estuary, public health, or the basin—but pathogens from the LOWWP will threaten these resources.

I.E.1.b.i. The 2002 Kitts DNA study confirms septic systems do not threaten the estuary, related habitat, or public health, and a community wastewater project will not benefit these resources. The Commission Staff Report of May 27, 2010, finds that septic systems pose a threat to the estuary and human health citing a 1998 CCRWQCB letter.

> *Increasing surface water impacts including: restriction of portions of shellfish harvesting areas because of rising bacteria levels; waters around the Los Osos area periodically do not meet bacteria standards for water contact recreation (such as swimming, wading, kayaking and small boat sailing); and the public is increasingly exposed to surface wastewater (See Cited Document 1, p. 12.)*

In a letter to the Commission prior to the January 2010 hearing (See I.D.3.), Roger Briggs, the Executive Officer of the CCRWQCB, implies septic systems pollute the estuary and the project is needed to reduce the pollution.

> *In order for the Los Osos watershed to be restored to a healthy state, both its groundwater and surface waters (including the Morro Bay National Estuary) need to be protected and improved… Bacteria is seeping into the estuary at high concentrations. (See Cited Document 5.)*

Despite the implication that the project will reduce pathogens in the National Estuary, the only evidence the CCWQCB Waste Discharge Requirement (WDR) (the CCWQCB permit for the project) provides to support this claim is a 2002 DNA study, commonly referred to as the "Kitts Study." (i.e., *Identifying the Sources of Escherichia coli Contamination to the Shellfish Growing Areas of the Morro Bay Estuary* Dr. Daniel Kitts, et. al.). (See Cited Document 10.) Referring to the study, the WDR states:

> *A DNA study completed on March 29, 2002, identified humans as the primary source of coliform bacteria in freshwater seeps from shallow groundwater along the estuarine edge of Los Osos. On December 13, 2002, the Central Coast Water Board adopted a pathogen Total Maximum Daily Load (TMDL) for Morro Bay, including an associated*

*implementation plan to achieve TMDL goals. Completion of the community wastewater system in Los Osos is a vital component of the Pathogen TMDL Implementation Plan (*WDR Order No. R3-2011-0001, May 5, 2011) (Emphasis added) (See Cited Document 11, p. 5.)

In a presentation to the LOCSD in 2005, Dr. Kitts repeats several times that the study is not designed to show the need for a community sewer, and he explains the study did not find human E. coli in oyster beds. He further states that the study shows only a fraction of 1% of pathogen loading in the estuary is from groundwater seeps, including the two seeps near Los Osos sampled in the study. When asked how much a centralized project would reduce pathogens based on the study, Dr. Kitts replies, "One percent, if you're lucky. My guess would be considerably less because of all the other possible sources of E coli." (See LOCSD Kitts pres.) Dr. Kitts points out that the study does not show the E. coli found in the seeps is from septic systems, he notes that 60% of the E. coli in the seeps is from non-human sources including birds, and he mentions possible sources other than septic systems as the source of human E. coli, including an "encampment" he saw nearby. He further explains that testing indicates the human E. coli taken from the Third Street Dock seep are from a single source, and mentions the possibility of "a failing septic system," indicating the number of septic systems involved would be very limited, if the source is septic systems. (Emphasis added). (See Cited Documented 12 and video recording of presentation submitted on disk.)

The published study reports that "Groundwater coliform loading is on the order of two magnitudes (100 times) less than the creeks" and human sources make up 40% in the seeps sampled. (See Cited Documented 10, pp. 24 and 31.). Thus, the Kitts study—the only source the CCRWQCB cites to establish the adverse impacts of septic systems on the estuary and potential project benefits on the estuary--shows groundwater sources of coliform bacteria contribute at most 0.5% (or 1/200th) of total loading to the estuary—and it does not show the 0.5% is from septic systems.

Although Dr. Kitts points out that E. coli levels in the seeps often exceed safe levels, the study does not show the source is septic systems, and his comments and the report confirm that a sewer system would not significantly reduce these bacteria levels, Therefore, rather than support the project, the Kitts study confirms the project is not needed to protect the National Estuary and related habitat, and it shows the CDP's assertion that the project is "critically necessary" to protect the estuary is not based on substantial evidence (e.g., accurate evidence.)

CCRWQCB (and SWRCB) officials initiated, oversaw, and/or funded the Kitts DNA study, so they knew and understood its results and implications. CCRWQCB officials (and SWRCB officials) knew and understood what these results meant and their importance. They also were aware other agencies, including the Coastal Commission, would rely on their assessment of the threat septic systems pose to the estuary and the potential benefit of the project in deciding whether to approve the project. The failure of the CCRWQCB (and SWRCB) to accurately represent the information establishes that

the CCRWQCB intentionally withheld information crucial to informed decision making, e.g., on the part of the Commission and other agencies reviewing/approving the LOWWP.

I.E.1.b.ii. Failing/flooding septic systems are no longer reported in the community; to the extent the potential remains, it is best addressed with an improved storm water management system, which is unaffordable with the LOWWP. The CDP claims that failing/flooding septic systems pollute the estuary and threaten public health and safety. (See Cited Document 1, e.g., pp. 11, 12, 70, 71.) However, evidence shows the issue (flooding septic systems) and related pollution/health and safety—to the extent the condition once existed--no longer exists. Evidence indicates reports of flooding septic systems stopped in the 1990's with installation of a storm drain system in the community. Evidence further shows that the conventional storm drain system installed sends urban runoff to the estuary and Los Osos Creek polluting these resources. The CCRWQCB will require upgrades/replacement of the system as part of a storm water management plan (SWMP) in the near future, but the high costs of the sewer will likely prevent or delay installation of the improvements because property owners will be unable to fund them. Available evidence also shows a sewer is more likely to contaminate the estuary than septic systems.

The Coastal Commission CDP Staff Report cites flooding (failing) septic systems as a reason the project is "critically necessary" to protect the estuary and public health.

> *As described, the RWQCB and other health agencies became concerned with the use of individual septic/disposal systems in the early 1970's when it was identified that the depth to groundwater is shallow enough in some areas of Los Osos to flood leach fields in wet weather. Surface flow and lateral seepage of inadequately treated wastewater posed adverse impacts to Morro Bay.* (See Cited Document 1., pp. 70.)

The CCRWQCB is again the source of the supporting evidence. The CDP Staff Report cites a 1998 CCRWQCB letter summarizing a 1995 CCRWQCB study (*Assessment of Nitrate Contamination in Ground Water Basins of the Central Coast Region Preliminary Working Draft)*, which states:

> *…Dependence on the deeper aquifer exacerbates the surface water problems because the community's water supply, formerly from the upper aquifer, is now drawn from the deeper aquifer and recharged (after use) to the upper aquifer causing groundwater levels to rise and flood more septic systems. Increasing surface water impacts including: restriction of portions of shellfish harvesting areas because of rising bacteria levels; waters around the Los Osos area periodically do not meet bacteria standards for water contact recreation (such as swimming, wading, kayaking and small boat sailing); and the public is increasingly exposed to surface wastewater.* (Emphasis added) (See Cited Document 1, pp. 10, 11, 70.)

Roger Briggs, Executive Officer, further supports the claim in his January 5, 2010, letter to the Commission urging approval of the project.

> *In order for the Los Osos watershed to be restored to a healthy state, both its groundwater and surface waters (including the Morro Bay National Estuary) need to be protected and improved These waters have been damaged by various water and wastewater practices and are currently far from being sustainable. Septic systems are destroying a vital and valuable portion of the upper aquifer systems. Bacteria is seeping into the estuary at high concentrations. During wet weather conditions, septic system effluent surfaces* (See Cited Document 5, pp. 1& 2.)

The above statements are not accurate for three reasons: 1) they suggest flooding septic systems are a significant source of pollution to the estuary and threat to health and safety, 2) they imply a wastewater project is needed to reduce pumping from the lower aquifer and/or reduce high groundwater and flooding, and 3) they imply the project will significantly reduce pollution of the estuary and threats to health and safety.

The 1995 CCRWQCB study (*Assessment of Nitrate Contamination in Ground Water Basins of the Central Coast Region Preliminary Working Draft)* is focused on nitrate levels in the region and provides no data or specific information on septic system flooding or surface pollution. (The LOSG was unable to locate the 1998 CCRWQCB letter in the record.)

In a Public Records Act (PRA) request, the Citizens for a Sustainable Community (CSC) asked the CCRWQCB and SWRCB for documents showing any harm to the public (e.g., reported illnesses from contact with septic system effluent or contaminated water)--and CSC received no information to show any actual harm has occurred. (See Cited Document 24, p. 5.) The City of Santa Cruz conducted a survey of people swimming in the San Lorenzo River and identified several cases of related illnesses. (See Cited Document 15, pp.21.) Furthermore, reports of surfers and others becoming ill from pathogen pollution of the waters off California's beaches are common. However, the Water Boards were unable to provide documentation of illness or other adverse health effects from contact with polluted water in or near Los Osos.

The low rate of repairs/failures show Los Osos septic systems do not pose a threat to the estuary or health and safety. The CCRWQCB provided a list of septic system repairs for 2008 and 2009 in response to CSC's request, which the County Department of Planning and Building provides annually to the CCRWQCB. The list shows about 110 septic system repairs/permits or about 55 per year for 2008 and 2009. (See Cited Document 52.) This represents about a 1% failure rate (55 of 4,700 systems) assuming all "repairs" noted resulted from failures. The lists did not show of repairs are concentrated in any particular location, e.g., near the estuary, and a 1% septic system repair/failure rate is low compared to the San Lorenzo River Watershed (1-3%). (See Cited Document 16, pp. 3-62 & 3-63.)

The Commission CDP Staff Report refers to the "1970's," so it apparently refers to conditions documented in some of the original supporting material for Resolution 83-13. The 1983 Resolution Staff Report and environmental document cite a number of septic system failures and citizen complaints in 1976 and between 1981-1983. (See Cited Document 19, pp. 000434, 000456, 000462,

000479, 000462, 000482-000484.) Reports of 15 or so failures in the Cuesta-by-the-Sea tract, located near the estuary, was the main source of concern. However, an unusual number of septic system failures or septic system problems are no longer reported in Cuesta-by-the-Sea or other Los Osos neighborhoods. The LOSG contacted the resident who reported problems in 1976, still living at the same location, and she said she had not seen or heard of any problems with septic systems in the area in at least 15 years. Further, the 2008-2009 repair list does not show an usual number of failures in Cuesta-by-the-Sea or other areas. Problems with flooding septic systems (to the extent they existed) have apparently disappeared. Employees at Al's Septic and the LOCSD confirmed that they do not receive reports of flooding septic systems, and they indicated that installation of a storm drain system in the 1990's remedied the problem. Better County oversight and code enforcement could have also contributed to fewer reports. Much more conservation has also likely reduced septic system failures and improved septic system function by reducing septic system loading and discharge rates. (Also see related discussion in Section I.E.3.a).

The Morro Bay National Estuary Program (MBNEP) monitoring program does not support that septic systems are a threat to the estuary or health and safety. The Volunteer Monitoring Program (VMP) sponsored by the Morro Bay National Estuary Program (MBNEP) samples surface water runoff monthly at three estuary sites near Los Osos, including near the Baywood Pier and Pasadena Point. Data summaries published in 2009 and 2010 show bacteria counts exceed "safe" levels in 13-25% of samples. (See Cited Document 20, pp. 3-2, 3-6, 3-7 and Cited Document 21, pp. 5.) The summaries do not indicate, however, that the level of exceedance is a concern or that the source is septic systems, and long-term trends are well within safe limits (half or below allowable limits). Urban runoff is often high in bacteria, and the area is a popular bird watching and dog walking spot, indicating two probable sources. (See Cited Document 20, pp. 3-4 & 3-5 and Cited Document 21, pp. 5-9.)

A septic system management plan will reduce septic system failures. The San Lorenzo Management River Watershed Management Plan (which the CCRWQCB approved in lieu of a septic system prohibition in 1995 for Santa Cruz County) includes a septic system management program. The plan implements the CCRWQCB Regional Basin Plan requirements for on-site systems with provisions that allow phased implementation. Property owners are required to meet standards when systems fail or residents apply for building permits, upgrading systems or replacing them with non-standard systems, as necessary. (See http://sccounty01.co.santa-cruz.ca.us/eh/sewage_disposal/ehseptic.htm, p.5.) According to the Management Plan, the program has resulted in significant improvements in septic system failure rates and surface water quality since implementation. (See Cited Document 15, p. 20 and Cited Document 16, pp. 3-63 to 3-64.)

In 1976, SLO County Environmental Health Department officials agreed with homeowners that problems in Cuesta-by-the-Sea stemmed from a failure to enforce standards. Better enforcement of standards since the 1980s has most likely contributed to low failure rates in Los Osos, but a well-designed and fully-implemented septic system management program would further improve septic system performance and address water quality and health-related concerns (to the extent they exist).

A septic system management program, with phased implementation applying Regional Basin Plan provisions for on-site systems, was available in June 2010 and has been available since the Water Boards approved Resolution 83-13.. However, the CCRWQCB did not inform the Commission of this option. (Also see Section I.E.3.a.)

A better storm water management system, which the CCRWQCB will require in the near future, would reduce flooding and pollution of the estuary, but the system will be unaffordable with the sewer. The WDR states that the LOWWP will reduce polluted runoff from flooding septic systems by reducing the polluted water now entering the estuary from a storm drain system in Los Osos. (See Cited Document 11, p. 9.) However, a good storm water management system using low impact development solutions (bio-swales, and linear parkway infiltration systems) will prevent flooding and stop polluted runoff much more cost effectively.

In the 1990's, the County installed the conventional storm drain system (pumps and culverts) in Los Osos to reduce flooding in low-lying areas (e.g., Paso Robles and 16th Streets, El Morro and 8th Streets, and Mitchell and Pine Streets). The conventional system remedied septic system flooding, but the system sends surface runoff to the estuary and Los Osos Creek. The Baywood Business District and Baywood Heights neighborhoods also have conventional systems that empty into the estuary. These conventional systems have undoubtedly increased pollution of the estuary and contributed to exceedances of safe bacteria levels. The MBNEP added an action item to its comprehensive plan in 2000 to improve the Los Osos drainage system, and the CCRWQCB will be mandating a storm water management plan (SWMP) to reduce pollution of the estuary and creek. (See Cited Document 14, CC-1 & CC-4). The current Los Osos SWMP is extremely weak, consisting only of educational programs (See Cited Document 17.) The high cost of the sewer precludes a good system that can prevent flooding, stop pollution of surface waters, and also recharge the basin, so the problem is likely to continue.

Low impact development (LID) has replaced conventional storm drain technology as the best management practice. In his DEIR comments, Roger Briggs recommends LID for some components the LOWWP. A community wide system is needed. (See Cited Document 13, pp. 6 & 7.) It would stop polluted runoff, recharge the basin, and even reduce nitrate levels in the groundwater. (However, it is unaffordable with the project.) (Note that CDP Condition 88, a voluntary plan to convert abandoned septic systems to infiltration systems, will not benefit the groundwater or habitat because it will not provide a net increase in the storm water percolating to groundwater and may cause pollution or health risks by rapidly flushing soils under septic leach fields or causing systems to overflow in heavy storms.

The LOWWP will most likely increase pollution of the estuary. The San Lorenzo River Watershed Management Plan reports that recreational use is restricted much more often near communities with sewers than communities with septic systems, citing leaks in sewer lines as one cause. (See Cited Document 15, p. 21, and Cited Document 16, p. 3-62). The CCRWQCB recently declared the San Lorenzo River area a prohibition zone for bacteria from urban runoff. This evidence supports that a

sewer does not reduce polluted runoff and could increase it, including health and safety risks. (See further discussion in Section I.E.1.b.v. below).

County and Water Board officials know the project could increase pollution of the estuary, flooding septic systems are not a significant issue, and concerns over flooding are cost-effectively addressed with storm water and septic system management measures, but they did not inform the Commission.

I.E.1.b.iii. The absence of coliform bacteria from septic systems in shallow test wells shows septic systems are functioning property and not polluting the estuary. Initial reports cited in the 1983 Resolution 83-13 Staff Report of widespread bacterial contamination of wells have not been substantiated by subsequent evidence in the record***.*** The "Phase I study" cited in Resolution 83-13 showed 26 out of 42 of the shallow monitoring wells had total coliform counts above "State Health Drinking Water Standards." (See Cited Document 19, pp. 000392-000393.) However, no studies we could find have corroborated these test results. High bacterial counts were not measured or reported in a 1987 CCRWQCB water quality study, and the fact that the CCWQCB has not required total coliforms to be measured, along with nitrates, in more recent monitoring programs supports that the CCRWQCB no longer believes the problem exists. (See Cited Document 22, and Cited Document 11, p. 4).

The San Lorenzo plan and a recent Stanford study both conclude that functioning septic systems do <u>not</u> pollute surface waters or ground waters. (See Cited Document 16, pp. 3-62 & 3-63, and Cited Document 26.) <u>The absence of fecal coliform in shallow groundwater in the area provides further proof that Los Osos septic systems are functioning properly, do not pollute the estuary, and do not pose a threat to health and safety.</u>

I.E.1.b.iv. The absence of any documented adverse health effects from septic systems in over 40 years shows septic systems are not a threat. The LOSG requested all evidence in the possession of the CCRWQCB and SWRCB documenting adverse health impacts from Los Osos septic systems--and we received none. (See Cited Document 24, p. 5.) After 40 years of septic systems use, the absence of documented health problems provides substantial evidence no adverse health effects are occurring and no significant health threat exists. In Santa Cruz County, officials surveyed people using the San Lorenzo River and identified cases of illness from pathogen contamination. (See Cited Document 15, pp. 17, 21.)

I.E.1.b.v. The LOWWP will not stop pathogen pollution of the estuary, and it poses a greater threat than septic systems to the estuary and public health (e.g., from overflows). As the evidence provided in Sections I.E.1.b.i-I.E.1.b.iv. shows, the LOWWP will not stop (or measurably reduce) pathogen pollution of the estuary, it is not needed to protect related public health and safety, and it will make cost-effective storm water management unaffordable. Furthermore, like all centralized projects, it is prone to large, destructive releases of pathogens to surface waters from leaks and overflows, not possible with individual failing septic systems.

The San Lorenzo River Watershed 2001 and 2009 management plans attribute long-term recreational use restrictions from high fecal coliform counts near Santa Cruz and Scotts Valley to urban runoff, including leaks in sewer systems. The reports further state that septic system management (which began in 1995) has resulted in the river near communities with on-site systems generally meeting safe swimming requirements. (See Cited Document 16, pp. 3-62 & 3-63.) Recently, the CCRWQCB declared the San Lorenzo Watershed, including Scotts Valley and Santa Cruz (communities with sewers), a zero discharge prohibition zone for pathogens to meet Clean Water Act Section 303 (d) goals. (See Cited Document 27.) Thus, installation of a sewer will not protect the estuary and could make the pollution worse.

In statements and documents, the County and CCRWQCB have intentionally misrepresented the LOWWP as a project that will not release harmful pathogens into the estuary, posing a threat to health and safety. On the other hand, the *California Beach Closure Report 2000* published by the SWRCB in 2001 shows that community sewer systems are the leading cause of beach closures due to high fecal coliform counts. (See Cited Document 28, pp. 3-699, 3-701). The serious threat sewers pose is dramatically illustrated in a Central Valley Regional Water Quality Control Board incident report for 2006, documenting the release of over 50 million gallons of sewage during one, two-day storm. Keith Wimer, a member of the LOSG, included the Beach Closure and Central Valley incident reports in his DEIR comments, so the County and CCRWQCB are aware of them. (See Cited Document 28, pp. 3-741 to 3-747).

According to the EPA, overflows from sewer systems are caused by inflow and infiltration (I/I), i.e., water leaking into a sewer system and overwhelming capacity especially during storms. (See Cited Document 28, p. 3-792). County and CCWQCB officials claim good maintenance and a Sewer System Management Plan (SSWP) will avoid this. The County also asserts that building 300,000 million gallons per day (mgd) of excess capacity into the LOWWP will prevent system over flows. (See FEIR, Topical Responses 10 & 12, Cited Document 29, pp. 3-9 & 3-11). However, the Scotts Valley system, about the same size as the LOWWP, a relatively new system (built in 1986) with a record for good maintenance, has about 350,000 AFY of I/I (the difference between wet weather and dry weather flows). In 2010, about 1100 gallons of raw sewage overflowed from system. (See Cited Document 30, Table 1 and p. 3.)

Last year (2011) in San Luis Obispo County, 25,000 gallons of raw sewage leaked into Santa Rosa Creek in the City of Cambria from the community sewer in two separate incidents, eventually flowing into the Pacific Ocean. A break in a sewer main below Lake Nacimiento (apparently still leaking) has released an unknown amount of sewage into the drinking water source. In March of 2011, 700 gallons of raw sewage overflowed onto streets in Shell Beach. In 2010, in San Luis Obispo County between 150,000 and a million gallons of sewage overflowed into a creek in Arroyo Grande from a County treatment facility. In the same year 50,000 gallons spilled into Chorro Creek resulting in the closure of the entire National Estuary to shellfish harvesting, and 15,000 gallons overflowed into San Luis Creek (steelhead habitat) resulting in County Health Department advisories. In 2008, 20,000 gallons overflowed from the

California Men's Colony treatment facility, causing restrictions in the estuary. All of these systems had SSMPs required by the CCRWQCB (See Cited Document 31.)

Harmful overflows from the LOWWP are inevitable, especially because the high cost of the system will make preventative maintenance, repairs, and upgrades much less likely. The community will not be able to pay for them. County and CCRWQCB officials know the LOWWP poses a significant threat to resources and public health from harmful spills, but they did not state this to the Commission.

I.E.1.c. Nitrates and other contaminants from septic systems in Los Osos do not threaten the estuary, public health, or basin sustainability. (However, the project makes basin sustainability less likely and can raise contaminant levels in the estuary and creeks causing harm to these systems.)

I.E.1.c.i. Despite statements by County Supervisor Bruce Gibson, nitrates from the upper aquifer do not adversely impact the estuary or related habitat.

At the Coastal Commission hearing January 14, 2010, Supervisor Bruce Gibson made the following statement (also cited above in Section I.D.2):

> *We've had over 30 years of pollution to the Morro Bay National Estuary… We have a project here that not only stops that pollution that I referenced but it goes several steps beyond correcting the consequences of that pollution which is the seawater intrusion that we've referenced." …. And now we respectfully ask for your concurrence on that matter (to find no substantial issue) and act to prevent an environmental disaster so we can act to protect the health of the community of Los Osos.* (Emphasis added) (See video of January 14, 2010, hearing.)

This statement not only inaccurately states that the project will benefit the National Estuary, but it falsely claims an "environmental disaster" is occurring that threatens health and safety, and the project will stop it. It further inaccurately states the project will stop seawater intrusion, suggesting the project is needed for basin sustainability, when the project makes the basin less sustainable. (See Section I.E.2.)

When Frank Ausilio, a Los Osos property owner, asked Supervisor Gibson on January 28, 2010, at a Los Osos Community Advisory Council (LOCAC) meeting to cite statements in the EIR supporting the claim that the project would benefit the estuary, Supervisor Gibson replied, "…the pollution of the Morro Bay Estuary is related to the pollution of the upper aquifer in the sense that that aquifer largely drains right straight into the bay." (See Co. Ausilio emails.) Mr. Ausilio followed up by email, asking Supervisor Gibson for the source of the information, and Supervisor Gibson replied, "The pollution issues are well documented in Regional Board Resolutions 83-12 and 83-13 and subsequent

hydrologeologic studies. The EIR you reference speaks to impacts of the proposed project.''(See Co. Ausilio emails)

Supervisor Gibson is aware that the EIR contains all relevant hydrogeologic information for the project, and that the EIR would have included the potential benefits of the project on the estuary, if the benefits existed. This exchange confirms, Supervisor Gibson was aware at this point, if not before, that the EIR, and the hydrogeologic studies contained in the EIR, did not support his claims, and his claims were not supported by substantial evidence in the record. After stating to the Coastal Commission on January 14, 2010, that septic systems are polluting the estuary, and the project "…would stop that pollution," Supervisor Gibson was obligated to correct the statements. He did not do this, as evidenced by the Commission Staff Report of May 27, 2010, which states that the project is "critically necessary" to protect the estuary.

Mr. Gibson made similar comments that septic systems significantly pollute and harm the estuary numerous times in public forums prior to February 2009. LOSG members heard them and talked to others who heard them. However, no one could remember Supervisor Gibson repeating these remarks after Mr. Ausilio questioned him about them. This provides further evidence that Supervisor Gibson knew after February 2010 that his statements before the Coastal Commission on January 14, 2010, were not accurate but failed to disclose the information to the Commission.

Shortly after receiving a response from Supervisor Gibson, Mr. Ausilio wrote to the Coast Commission, citing Supervisor Gibson's testimony, and requesting Commissioners to confirm the veracity of similar statements in the Commission Staff Report of December 22, 2009. Mr. Ausilio's letter stated in part,

> *I am requesting the Coastal Commission to determine the source and veracity of the statements regarding the alleged contamination of the Morro Bay estuary by nitrates coming from Los Osos septic systems. If you are unable to corroborate those statements, I request that your staff report be corrected by removing references to pollution, contamination, and degradation of Morro Bay." (See Cited Document 2, Exhibit 4, pp. 257-264.)*

Given the importance of the issue, the LOSG assumes Commission Staff contacted Mr. Gibson, other County officials, and/or CCRWQCB officials to check the accuracy of the statements, and the officials continued to provide inaccurate, erroneous, or incomplete information asserting that septic systems are a significant source of pollution to the estuary and the project is critically and urgently needed to stop that pollution. Again, we assume this because the statements and findings appearing in the Commission Staff Report of May 27, 2010, continued to assert that septic systems substantially pollute the estuary and threaten health and safety.

As Mr. Ausilio points out, the "pollution" Supervisor Gibson refers to is apparently nitrate pollution since all other contaminants in the upper aquifer are below Title 22 standards for drinking water. However, neither the EIR, nor any other available report or study, including Resolutions 83-12 and 83-

13, states that the upper aquifer pollutes the estuary with nitrates or other contaminants (except the County report to USDA, which is inaccurate and erroneous—see Section I.E.3.a.) Furthermore, the absence of nitrate pollution in the estuary can be easily confirmed. The San Luis Obispo Science and Ecosystem Alliance (SLOSEA) tests the water quality of the National Estuary and publishes the results on its website. The data show very low nitrate levels in the estuary near Los Osos and in the estuary in general (about 1 mg/l). Also, the MBNEP Volunteer Monitoring Report shows no signs of "nuisance" algae blooms in the estuary (a sign of high nutrients including nitrates) although it identifies nitrate-related problems in creeks. (See Cited Document 20, e.g., 2-86 & 2-87 and Cited Document 21, e.g., pp. 11-13.)

Available well test data, in fact, support that nitrate levels in outflows from the upper aquifer are very low (well below monitoring test averages) due to a unique characteristic of the basin. The Third Street Well, used as both a monitoring and production well, is located near the estuary shoreline in Los Osos. The well consistently tests very low in nitrates, 2 to 3 mg/l N03-N at shallow testing depths (6-7 feet), and 4-6 mg/l N03-N at the deeper production depths, 60-70 feet. (See Cited Document 11, Table 1 and Cited Document 32, Table 3, p. 5.) [Note: The CCRWQCB WDR incorrectly reports nitrate levels at the Third Street Well (7N1) as 29 mg/l rather than 2.9 mg/l. (See Cited Document 11, Table 1 and Cited Document 32, Table 3, p. 5.).]

This evidence, the SLOSEA data, and the lack of algae blooms after 40 years of septic system use provide substantial evidence that no adverse impacts from septic systems or basin outflows are occurring. The evidence further supports that Supervisor Gibson and other County and/or CCRWQCB official knew nitrates and outflows from the upper aquifer were not harming the estuary but did not provide accurate and complete information disclosing these facts to the Commission.

I.E.1.c.ii. Nitrate pollution of the estuary and related habitat is from runoff, not septic systems, according to the WDR and SLOSEA data. Although Los Osos Creek is listed as impaired for high nitrates under the Federal Clean Water Act Section 303 (d), the CCRWQCB WDR confirms the source of nitrates is surface run off (see Cited Document 11, p 5). SLOSEA data further shows surface runoff is the only significant source of nitrates entering the estuary. The data show the highest concentrations of nitrates in the estuary are near where creeks enter the estuary from surrounding farmland. Data also show spikes in nitrates during the rainy season, which further supports that the source of nitrates run off. (See Cited Document 21, pp. 11-13).

I.E.1.c.iii. Nitrate levels had stabilized in the upper aquifer by June 2010, evidence showed the project would not increase the beneficial use of the water in the foreseeable future, and programs and measures that could increase beneficial use and reduce nitrates (achieve project objectives) were available. The CDP Staff Report of May 27, 2012, identifies increasing nitrates in the upper and

lower aquifers as a reason for the project, referring to a 1998 letter from the CCRWQCB, summarizing a 1995 study. The Staff Report states:

> *In 1995, a study issued by the RWQCB titled "Assessment of Nitrate Contamination in Ground Water Basins of the Central Coast Region Preliminary Working Draft", highlighted <u>significant increases in nitrate concentrations in both the lower and upper aquifers</u>.*

The information provided by the CCRWQCB indicating nitrate contamination is getting worse in the basin is not accurate or complete. Both the 2005 and 2006 nitrate monitoring studies, in the possession of the CCRWQCB and County prior to June of 2010, conclude that nitrates in test wells (mostly Zone A) were near equilibrium under land use conditions at the time (which haven't changed). (See Cited Document 32, p. 11 and Cited Document 33.) The 2006 monitoring data show average nitrate levels had stabilized at 10.5 mg/l, with 12 of 28 wells testing below the Regional Basin Plan objective of 10 mg/l and one at 10 mg/l. The 2003 Yates and Williams study further indicates that nitrate levels in the upper (production) aquifers (Zones B and C) were had stabilized in 2003. (See Cited Document 34, p. 19.) According to the EIR, the average nitrate level of basin recharge (based on the 2003 Yates and Williams study) is 10.9 mg/l, and the project will reduce that average (and the average in Zone B & C) to 8.3 mg/l over thirty years. However, the timeframe for nitrate reduction could be much longer because the Yates and Williams study was based on the disposal rates of the prior project (i.e., 900 AFY of disposal at Broderson versus 450 AFY with the LOWWP), so the LOWWP will result in a much slower turnover (replacement) rate of upper aquifer water (i.e., twice as long--60 years.)

The Yates and Williams study indicates that the reduction in nitrates will be slow due to the relatively high nitrates in the effluent disposed at the Broderson (7 mg/l) and relatively high background nitrates in the basin, and it states nitrates could rise in some wells with the project (e.g., down slope from the Broderson disposal site). The study shows 55% to 70% of the nitrates in the groundwater are from sources other than septic systems, with over 25% from domestic pets, livestock, weeds, landscaping, and natural vegetation. (See Cited Document 34, pp. 17-20, Tables 1 & 2, and 10.)

Thus, the project does not increase the beneficial use of the upper aquifer in the foreseeable future (because nitrates will not be reduced appreciably for many years--if at all). On the other hand, purveyors are pumping water from the upper aquifer now for drinking and plan to treat the water for nitrates to increase beneficial use. Further, the State Water Board is requiring all water basins to implement a salt and nutrient (nitrate) management plan to comply with Recycled Water Policy the State Board adopted in February 2009. (See Cited Document 70, p. 59.) Such plan could reduce nitrates without the project based, on the above evidence showing substantial nitrates from non-septic system sources. Additionally, septic system management, storm water management, conservation can reduce nitrates—without the project. (See Sections I.E.1.d.ii., I.E.1.d.iii., and Parts II.E and IV.D for further discussion of the benefits of a comprehensive management alternative.)

(Note: The CCRWQCB required a salt and nutrient management with the LOWWP, but the SWRCB would have required it anyway.)

Finally, a decline in population since 2000--and a substantial reduction in water use from conservation since 2004--could have already reduced average nitrate levels in shallow wells. Eugene Yates points out that conservation can reduce nitrate levels by increasing the dry zone under septic systems, which allows greater natural treatment of nitrates in the soil. (See Cited Document 35, p. 2.) Members of the LOSG and general public have requested that the County and CCRWQCB conduct further monitoring studies, but the agencies have declined to do so.

Thus, prior to the June 2010 hearing, County and CCRWQCB officials had information showing nitrate levels had stabilized just above Regional Basin Plan objectives (and could have been lower by June 2010), the LOWWP would not increase the beneficial use of the water in the foreseeable future (if at all), purveyor treatment would increase the beneficial use of the water, and nitrate management (required by the SWRCB) could potentially achieve project and Regional Basin Plan objectives without the project (especially in conjunction with other management measures). However, the CCRWQCB and County did not provide this information to the Commission.

I.E.1.c.iv. The potential for contaminants from the upper aquifer to pollute lower aquifers is insignificant and best addressed with management measures and pumping changes.

Based on CCRWQCB information, the CDP Staff Report of May 27, 2012 also indicates that nitrates in the lower aquifer have significantly increased and it implies a wastewater project is needed to address the issue:

> *In 1995, a study issued by the RWQCB titled "Assessment of Nitrate Contamination in Ground Water Basins of the Central Coast Region Preliminary Working Draft", highlighted significant increases in nitrate concentrations in both the lower and upper aquifers.*

Information in the possession of the CCRWQCB and County, including the 2005 Seawater Intrusion Study (Cleath and Associates), confirm that, after 40 years of septic system use, the lower aquifer shows no signs of increasing nitrate or other septic system contamination. (See Cited Document 37, p. 13.)

The CCRWQCB document cited in the CDP ("Assessment of Nitrate Contamination in Ground Water Basins of the Central Coast Region Preliminary Working Draft", Briggs, 1995) is apparently inaccurate. (See Cited Document 51, e.g., pp. 72-80.) The document lists a 1983 Brown and Caldwell report and the 1988 USGS report as references, but the latter does not state that nitrates have increased. (See Cited Document 37, p. 13.) According to the 2005 Seawater Intrusion Assessment, a nitrate study in 1994 by Metcalf and Eddy (Task F) further confirmed "'… no historical trend of increasing nitrates in the

deep aquifer,'" (See Cited Document 37, p. 13.) Despite the availability of this information, CCRWQCB officials did not supply it to the Commission.

The 2005 Seawater Intrusion Assessment and 2003 Yates and Williams study indicate that nitrates and other contaminants in the upper aquifer could eventually migrate to the lower aquifers. However, the absence of any signs of increasing nitrate contamination in these aquifers after more than 40 years of septic system use (except some leakage from wells) provides substantial evidence that no significant contamination will occur in the foreseeable future (especially with comprehensive basin management). (See Cited Document 37, p. 13 and Cited Document 34, p. 20. Also see Sections I.E.2.iii, I.E.2.iv., and I.E.3.a. for further discussion of the uncertainty associated with Broderson leach field and upper aquifer recharge of the lower aquifer.)

Purveyors are planning to address seawater intrusion with major shifts in pumping to the upper aquifer and cooperative nitrate treatment, blending, and conservation. Much less water pumped from the lower aquifers will reduce the potential for the upper aquifer to contaminate the lower further. Assuming basin modeling (for the 2008 EIR and 2009 ISJ Urban Yield TM) is relatively accurate, the major shift in pumping will reduce leakage from the upper to the lower aquifer by 60% (882 AFY down to 357 AFY) (See Cited Document 38, Basin Balance charts, pdf pages 13-24; Cited Document 39, p. 2; and Cited Document 40, pp. 3, 4.) Thus, the potential for contaminants in the upper aquifer to reach the lower is substantially reduced by the shift.

Moreover, The Yates and Williams study points out the size of the lower aquifer relative to the upper (10 times larger) reduces the potential for the upper aquifer to contaminate the lower by a factor of 10 due to dilution (See Cited Document 34, p. 20.) A substantial reduction in water use from conservation since 2004 also substantially reduces the rate of discharge from septic systems, the amount of water recharging the upper aquifer, and turnover rate of the aquifer (migration of contaminants).

Further, purveyors plan to treat the upper aquifer for nitrates. This could reduce nitrates in parts of the upper aquifer with the highest concentrations, also reducing the potential for lower aquifer contamination. Pumping tends to draw in and concentrate nitrates. (See Cited Document 34, p. 20.) Further, a 2006 upper aquifer study by Cleath and Associates shows that contaminants affecting upper aquifer wells are concentrated near the top of the aquifer (Zones B & C). (See Cited Document 41, p. 15, 16.) <u>This evidence further supports that contaminants can be managed by pumping practices</u>.

Well shaft contamination of the lower aquifer can also be addressed with management. The LOCSD's South Bay well was removed from service much of the past two years because nitrates from the upper aquifer apparently leaked to the lower aquifer when the well was shut down. This apparently prevented upper-lower aquifer blending to meet drinking water standards. The LOCSD recently applied for a $600,000 grant from the SWRCB to install a nitrate treatment facility for the well. Better

well construction and well management (e.g., shutdown precautions), in addition to nitrate treatment (e.g., cooperative treatment and blending) would address this issue and optimize basin production.

The above information shows the CCRWQCB did not provide accurate and complete information regarding nitrates in the lower aquifer. Nitrate pollution is not increasing. The information also shows the potential for septic systems to pollute the lower aquifer is insignificant, and management will avoid the potential problem (i.e., a wastewater project is not necessary). The information provided here was possession of the CCRWQCB and County at the time of the June 2010 hearing, but the agencies did not provide it to the Commission.

I.E.1.c.v. Emerging contaminants found in upper aquifer wells do not threaten health and safety, and a wastewater project will add emerging contaminants to the water supply. A 2006 upper aquifer study shows signs of emerging contaminants in some parts of the upper aquifer. The report indicates the contaminants are at "notification" levels (below "response" levels). (See Cited Document 41, p. 16.) The study found emerging contaminants (aka, contaminants of emerging concern CECs) in the upper portions of the upper aquifer and not the deeper portions considered for domestic water use. According to the study, the presence of the contaminants indicates septic system influence. However, disposal of treated effluent at the Broderson site and the use of recycled water from the project will add CECs to the basin water supply. (See Cited Document 49, p. 8 and Exhibits, and Cited Document 42.)

A growing number of studies show that community sewers are the source of disinfection by-products [e.g., N-nitrosodimethylamine (NDMA)], drug resistant bacteria, and other contaminants that pose serious health and safety risks to the public. [See Cited Document 49, p. 8 and Exhibits (Exhibits are on disc).] On the other hand, the SWRCB environmental impact document for its draft statewide on-site system regulations (per SB 885) finds impacts from emerging contaminants to be "insignificant" because the adverse health effects from the contaminants are not well understood and (to some extent) because CEC are so widespread in the environment they have become a fact of life. (See Cited Document 43, pp. 182-186).

Moreover, purveyors can treat upper aquifer water for CECs at the well along with nitrates, if needed, also applying new technologies and treatment processes to remove CECs as technologies/processes are developed). Treating CECs at the well is much more cost effective than with a wastewater project in Los Osos. A 2008 technical memorandum prepared by the County shows the cost to build a water treatment facility to fully treat up to two million gallons per day (mgd), enough for the entire urban area, would be about $8 million. (See Cited Document 44, p. 15.) Therefore, the project does not remove CECs and is not needed to remove CECs to increase beneficial use of the water. On the other hand, it can be a significant contributor of CECs and drug resistant bacteria. The County and CCRWQCB

were in possession of this information prior to the June 2010 hearing but did not provide it to the Commission.

I.E.1.d. Despite official claims that the basin is not sustainable without a wastewater project, evidence supports that current conditions are sustainable--except for seawater intrusion. Sensitive habitat is thriving under present conditions (and the project will adversely impact habitat), while comprehensive management provides the best opportunity for resource sustainability.

I.E.1.d.i. Sensitive habitat, including the estuary, is sustainable and thriving under current conditions.

In a letter to the Coastal Commission date January 5, 2010, Roger Briggs, Executive of the CCRWQCB states:

> *In order for the Los Osos watershed to be restored to a healthy state, both its groundwater and surface waters (including the Morro Bay National Estuary) need to be protected and improved. These waters have been damaged by various water and wastewater practices and are currently far from being sustainable.*

The CDP indicates that the project is essential to protect habitat. It states,

> *…a much needed and well-conceived beneficial coastal resource project that is essential to protect ground and surface waters in and near Los Osos, including the Morro Bay National Estuary and related habitats and resources…* (Emphasis added.) (See 44, pp. 7 & 8.)

Despite this statement and finding, no available evidence shows that sensitive habitat along the estuary (e.g., wetlands, springs, and marshes) are being adversely impacted by septic systems. Evidence shows only that the opposite is true: Wetlands, marshes, and springs supporting the estuary, including Willow Creek Drainage (Willow Creek and Eto Lake) are healthy and thriving partly as a result of septic system use, while the project will potentially adversely affect that habitat. Los Osos Creek is listed on the 2002 Clean Water Act 303 (d) list as impaired by nitrates and fecal coliform. However, the WRD indicates that the source of the nitrate is run off, not from septic systems--and run off is also the most likely source of coliforms in the creek (possibly from the conventional storm drain system that empties into the creek.) (See Cited Document 11, p. 5.) (Also see Sections I.E.2.b.1. & I.E.3.a.)

Furthermore, available evidence indicates the project will adversely impact sensitive habitat along the estuary by reducing groundwater flows and increasing contamination (Also see Section I.E.2.b.) The fact that the project does not identify specific measures to replace flows increases the likelihood

of adverse impacts to the resources and it supports the conclusion that mitigation measures are not feasible. (Also see Sections I.E.2.d.iv. & I.E.2.d.v.) Adverse impacts to wetlands could increase contaminant levels in the estuary and creeks by removing the natural buffering effect of wetlands. Applying recycled water to replace flows and/or for irrigation in the area could also significantly increase contaminant levels in the habitat. (Also see Section I.E.2.b.ii.)

I.E.1.d.ii. Purveyors plan to treat for the upper aquifer for nitrates, as needed, which increases the beneficial use of the aquifer; treatment and nitrate management could achieve the project objective for less than 1/20th of the project cost. The treatment of nitrates at the well, as needed, before water is delivered to customers is far more cost effective in Los Osos than treatment with a wastewater project. Based on the capital cost of a facility to treat 150 AFY at the South Bay Well ($600,000), the capital costs to treat the remaining potential production from the upper aquifer (about 900 AFY) would be under $4 million. (See RWQCB ISJ Update, p. 3.) According to a project technical memorandum, the capital cost for a facility to treat enough water to supply the entire urban area (over 2000 AFY) for all contaminants, not just nitrates, would be about $8 million. (See Cited Document 44, p. 16.) The $4 million cost is 2% of the project cost of $190 million, and the $8 million is 4%. Well-head treatment allows purveyors to target portions of the upper aquifer showing signs of contamination as a management strategy to actively reduce contamination.

The San Lorenzo River Management Plan indicates that the septic system and nitrate management programs have reduced nitrates in the watershed, and it indicates that feasibility studies have consistently found septic system-nitrate management to be more cost-effective than installation of a community sewer system. (See Cited Document 53, pp. 4, 20. 28.) The cost of septic/system wastewater management in the San Lorenzo Watershed in 2001 (for the management of over 13,000 septic systems; Los Osos has approximately 4,500) was about $340,000 per year, or about $25 per year per property owner. (See Cited Document 53, p. 29.) Based on these costs a reasonable estimate for a Los Osos program would be well under $1 million per year ($40 per year per property), assuming a conservative 5% inflationary factor. This is about 1/200th or 0.5% of the cost of the $190 million LOWWP and about half of the LOWWP's annual operating cost.

<u>CCRWQCB officials were aware in June of 2010 that nitrate treatment is a viable method for reducing nitrates and increasing beneficial use, which is more cost effective in the Los Osos Valley basin than a wastewater project. The CCRWQCB also regulates water quality in the San Lorenzo River Watershed, so CCRWQCB officials were aware that nitrate and septic system management would reduce nitrates for less than 1% of the cost of the LOWWP, but did not provide the information to the Commission.</u>

I.E.1.d.iii. Comprehensive basin-wide/watershed management, with integrated septic system, salt and nutrient (nitrate), storm water management (LID/basin recharge), and conservation--without the project--provides the best chance of stopping seawater intrusion and achieving basin/area sustainability. It also achieves project and Basin Plan water quality objectives. The County and CCRWQCB officials have inaccurately claimed that the project is essential for basin sustainability (See Sections I. D.3., I.E.1.d.i. and I.E.2.a.iii.) However, the project is not needed to stop seawater intrusion because it is not needed to reduce pumping of the lower aquifer (e.g., by increased pumping of the upper aquifer or from conservation). Further, nitrates do not threaten the basin, and management measures could achieve the long-term potential nitrate reductions of the project. On the other hand, the project will reduce groundwater flows to the aquifers potentially making the critical seawater intrusion problem worse and harming sensitive habitat (See Section I.E.2. below). Therefore, the project only makes basin sustainability less likely, while management can achieve project benefits and much more.

Comprehensive conservation and purveyor water management (pumping shifts and nitrate treatment), are essential for basin sustainability. Combined with septic system, nitrate, and storm water management (recharge)—without the project—they provide the best chance for basin sustainability. This is because comprehensive management allows the most cost-effective measures to be applied when and where they are needed most—to stop/reverse seawater intrusion in the short term and reduce/manage contamination (nitrate, seawater, and other contamination) in the long-term. Comprehensive management allows conservation (the most effective seawater intrusion mitigation measure) to be applied to stop seawater intrusion, rather than to mitigate for the project, and it applies other cost-effective measures (septic system, nitrate, and storm water management) to maximize long-term water-supply, water-quality benefits. Comprehensive management also minimizes disruptions to the basin and avoids potential adverse project impacts. This avoids the need for costly and uncertain mitigation measures and it makes basin planning predictable. Thus, it allows purveyors to move ahead with essential management measures. Comprehensive management also stops pollution of the estuary from runoff, avoids substantial GHG emissions and fossil fuel consumption, and cuts project costs by 90%, so it avoids the project's major socio-economic impacts. For all of these reasons, it provides the best chance for basin sustainability--and the sustainability of vital resources in the area (environmental, social, and economic).

(Also see Part II for benefit-risk-costs comparisons and Part IV.D. for a list of program benefits.)

<u>Comprehensive management that maximizes conservation/water-use efficiency (e.g., greywater reuse and rainwater harvesting) is necessary for basin sustainability.</u> Recent information shows that water use in the urban area has gone down by 700-800 AFY since 2004, while seawater intrusion has accelerated. (See Section I.E.2.j., Table 1.) This evidence indicates that almost all the seawater intrusion mitigation potential from the County draft conservation plan (prepared for the ISJ Working Group by Maddaus Water Management) has been applied. Nonetheless, conservation provides the most direct and cost-effective way to stop/reverse seawater intrusion, which continues to progress

through the basin. The remaining potential must be maximized and applied to seawater intrusion directly (not to project mitigation) to provide the best chance for basin sustainability.

A review of the County-proposed draft conservation plan by Peter Mayer of Aquacraft concludes that a target of 42 gallons per capita per day (gpcd) is doable in Los Osos in the near future. This would reduce water use beyond the 50 gpcd target of the draft plan, providing another 100 AFY, or so, of seawater intrusion mitigation. A basin-wide water use efficiency program implementing greywater reuse and rainwater harvesting strategies could further reduce potable water use. Comprehensive management allows this remaining mitigation potential to be applied directly to seawater intrusion.

Comprehensive management also allows a community-wide storm water management/recharge program to be implemented (which would be unaffordable with the project). The project/program helps achieve basin sustainability in four ways: 1) by recharging the basin, 2) by stopping pollution from urban runoff of the estuary and habitat, 3) by addressing the potential for septic system flooding, and 4) by reducing nitrate/contaminant concentrations in groundwater.

An integrated comprehensive plan similar to the San Lorenzo Watershed Management Plan provides a good model for a comprehensive plan to achieve basin sustainability. The San Lorenzo River Valley Watershed Management Plan integrates septic system and nitrate management, with storm water recharge, monitoring, and other management programs. The County of Santa Cruz administers the program, but many agencies took part in program development and continue to participate in program implementation and oversight. (See Cited Document 54, e.g., pp. 3-60 to 3-64). A similar coordinated, multi-agency management effort, implemented with a basin-wide ordinance, provides the best chance for the sustainability of the Los Osos basin.

The San Lorenzo plan includes septic system management that applies the Central Coast Regional Basin Plan requirements for on-site systems. However, it allows existing systems to remain in place until systems fail, owners apply for building permits, or the owner sells or refinances a property, at which time systems are upgraded to meet current standards, if necessary. (See Cited Document 53, p. 25 and Santa Cruz County Environmental Health website: **http://sccounty01.co.santa-cruz.ca.us/eh/sewage_disposal/ehs-88.htm**.) The 2001 management plan describes the program as follows:

> *The program provides for management and improvement of approximately 13,500 individual onsite sewage disposal systems in the San Lorenzo River Watershed, which have historically contributed to elevated nitrate and pathogen levels in the River. Proper septic system functioning has been challenged by age of systems, small lot size, high winter groundwater levels, steep slopes, close proximity to waterways, and common occurrence of clay soils or excessively drained soils. The Wastewater Management Program has sought to overcome these constraints through water quality monitoring, system inspection, upgrade of systems to effective standards, public education, and tracking of system performance* (See Cited Document 53, p. 25.)

The CCRWQCB declared the San Lorenzo River Watershed to be a prohibition zone in 1982, but allowed Santa Cruz County to implement septic system management as part of a comprehensive management plan for the area, in lieu of community wastewater projects (See "Septic Systems and Design Standards in Santa Cruz County,"p.1 **http://sccounty01.co.santa-cruz.ca.us/eh/sewage_disposal/hsseptic.htm.)**

The 2001 Watershed draft management plan states that just five years after septic system and nitrate management measures were put in place in 1995, "improvements in bacterial levels and nitrate levels (had) already been observed," adding that wintertime septic system failure rates decreased from 5-14% to 1-3%. (See Cited Document 53, pp. 4, 20.) The 2009 final plan reports that "nitrate levels increased dramatically in the 1970's as a direct result of development and poor septic system management, but increases since the 1990s have been low to insignificant due to management practices…" (See Cited Document 53, pp. 4, 20, 21,25, 28 and Cited Document 54, pp. 3-60, 3-61.)

Comprehensive management in Los Osos basin is likely to be more effective than in the San Lorenzo River Watershed for three important reasons: 1) management will be less complex, 2) the structure of the Los Osos basin is conducive to protecting groundwater, and 3) nitrate sources, extensive wetlands, and soil characteristics contribute to better water quality management.

The Los Osos basin has a much smaller geographical footprint, fewer stakeholders, a more limited set of geological conditions, and a narrower set of water quality-supply issues that the San Lorenzo Watershed. The San Lorenzo management plan encompasses several water basins, addresses a wider set of issues, and involves many more water companies and other stakeholders. Santa Cruz County Environmental Health, for instance, manages (monitors and oversees) 13,000 septic systems in at least 10 communities throughout the Watershed.

Also, the Los Osos basin's large lower aquifers--nine-tenths of basin's capacity supplying three-fourths of current production--lie beneath a 50-feet thick clay layer (the regional aquitard). This protects the resource from surface pollution. The lower aquifers show no signs of increased pollution—other than seawater contamination and from well shaft leakage--after more than 40 years of development in the area. (See Cited Document 37, p. 13.) Careful management, e.g., of pumping practices, can help ensure they remain unaffected by surface pollution.

Nitrate sources in the basin and extensive wetlands in the area will make nitrate management more effective. The Yates and Williams study (2003) reports that over 25% of nitrate loading in the basin is from domestic pets, livestock, weeds, and irrigated landscaping. (See Cited Document 34, Table 10.) The San Lorenzo Watershed management plan shows nitrates from these sources to be much less (e.g., 12% or so) (See Cited Document 53, p. 19.) Therefore, a nitrate management program aimed at reducing non-septic system sources would be more effective in reducing nitrates in Los Osos. Also, extensive wetlands, including Willow Creek Drainage riparian habitat, boarder the estuary and buffer nearly all sensitive surface waters in the area from polluted runoff (e.g., Los Osos Creek). Managing/maintaining these natural barriers will help ensure the sustainability of surface waters.

Soil quality in Los Osos provides greater nitrate reduction than in the San Lorenzo River Watershed. In the San Lorenzo River area septic systems are estimated to contribute 57% of nitrates to the groundwater in areas with septic systems, with just 15% reduction from the soil (i.e., natural treatment--filtration and microbial action). (See Cited Document 54, p. 3-60.) In Los Osos nitrate loading from septic systems is estimated to be 47%, with much more treatment in the soil (67%), according to the 2003 Yates and Williams study (used in the EIR to estimate nitrate loading with the LOWWP.) (See Cited Document 34, p. 17 and Table 2.) The 47% is from all septic systems throughout the urban area. About 13% of septic systems are located outside the prohibition zone, so septic systems within the prohibition zone contribute about 41% of nitrates.

This difference in nitrate reduction is likely due to the particular soil characteristics and geology of the Los Osos basin (e.g., finer grained silty sands as opposed to coarse grained sands in the Felton area of Santa Cruz County). Soil characteristics result in slower percolation, longer residence time, and greater natural treatment of septic system effluent. The FEIR describes the unique cleansing properties of Los Osos soils to explain why Broderson discharge (448 AFY of treated effluent containing nitrates and other contaminants) will be adequately treated prior recharging the groundwater.

> *Opportunities for realizing beneficial basin results lie in the unique geology and soils in Los Osos… Ancient dune sands overlie the Paso Robles formation and create an effective water cleansing and storage condition… A partial key to this effect is the presence of lamellae, which are thin clay layers (finer than a pencil) with a coating of iron oxides both above and below each layer. As water contacts these discontinuous layers, it tends to move laterally until reaching the edge of the lamella, then stair steps downward before reaching the next layer. This effect both slows and spreads the water, allowing more soil contact time with its accompanying filtering and cleansing effects, preventing over-rapid inflow of treated effluent into the deeper water bearing layers below.* (See "Topical Response 8: The Broderson Leachfield," Cited Document 29, p. 3-7—p. 21 of pdf.)

Dr. Reuhr, a Soil Scientist and Professor at CSU Cal Poly, San Luis Obispo, confirm the unique properties of Los Osos soils in a paper written in 2006. (See Cited Document 55.) (The above FEIR excerpt borrows from Dr. Reuhr without citing him.)

While the FEIR states that Los Osos soils are particularly beneficial to Broderson recharge, the same soils exist throughout the urban area–i.e., ancient dune sands overlying the deeper Paso Robles formation, sometimes with larger clay lenses slowing percolation. Thus, all water percolating from septic systems and other sources undergoes this unique treatment/cleansing process. Evidence of the high level of natural treatment is shown by the fact that septic system leachate has nitrate levels of between 40 and 50 mg/l, while the average nitrate levels of groundwater a few feet below the surface (per the 2006 nitrate monitoring study cited in the WDR) is 10.5 mg/l. Thus, the basin's natural systems reduce nitrate concentrations by about 75-80% in just a few feet of soil. If Broderson disposal works exactly as planned, the project would reduce average nitrate concentrations in the upper

aquifers by 80-85%, improving the system by about 5% over 30-60 years (i.e., reduce nitrate levels to 8.3 mg/l). Achieving Regional Basin Plan objectives (reducing average nitrate concentrations to below 10 mg/l) requires improving the current system by just 1-2% (or reducing the 10.5 mg/l average by 5-10%). The project objective is simply to "alleviate (reduce) contamination—primarily nitrates." Both the Basin Plan objective and project objective can be achieved by several management measures

Comprehensive basin management reduces nitrates and achieves project and Regional Basin Plan objectives in five ways 1) septic system management, 2) nitrate management, 3) nitrate treatment at the well, 4) comprehensive conservation, and 5) community-wide storm water management (recharge.) The San Lorenzo Watershed management plan reports that septic systems and nitrate management programs reduce nitrates in the Watershed, and the factors discussed above (e.g., the higher percentage of nitrates from non-septic system sources) support that greater reductions will occur in the Los Osos basin. The salt and nutrient (nitrate) management program required by the SWRCB will, therefore, most likely achieve project objectives. The San Lorenzo septic system management plan also provides for septic system upgrades that reduce nitrates. These can be phased in, if necessary, to meet long-term goals (if adverse impacts from elevated nitrates are observed). However, nitrate-reduction upgrades would not likely be necessary. Purveyor nitrate treatment, as discussed in Sections I.E.1.c.v. and I.E.1.d.ii, will reduce nitrates. Conservation could also reduce nitrates by slowing the rate of septic discharge and increasing the dry (vadose) zone under septic systems increasing natural nitrate treatment. Xeriscape (as part of a water-use efficiency-nitrate management program) will reduce nitrates by reducing nitrate fertilizer use, green waste, and high-nitrate-producing landscaping. On-site rainwater harvesting will also reduce nitrates by retaining and infiltrating rainwater on site as part of a community wide storm water management (recharge) program. Eugene Yates confirms these benefits from conservation and storm water recharge in his June-August review. (See Cited Document 35, pp. 2 & 3.)

A community wide storm water management program has multiple benefits: Besides reducing seawater intrusion and stopping pollution of the estuary, it could achieve Regional Basin Plan nitrate objectives. Rainwater has very low levels of nitrates. As discussed in Section I.E.1.b.ii., storm water is now collected from several neighborhoods in Los Osos and pumped or drained to the estuary and Los Osos Creek via a conventional storm drain system (concrete ditches, pipes, and culverts). Thus, a considerable amount of potential recharge is lost, which also pollutes sensitive habitat. The CCRWQCB will require a storm water management plan (SWMP) in the near future to address this issue, and will likely require a program emphasizing low impact develop (LID) (e.g., rain gardens and bio-swales). Roger Briggs points out the benefits of LID in his DEIR comments. (See Cited Document 63, pp. 7 & 8.) A community-wide LID system will not only reduce flooding and polluted runoff, but it will lower nitrate/contaminant concentrations in the groundwater by increasing basin recharge and diluting contaminant concentrations in recharge.

Emily Ayers of the LID Center in Maryland states in an email to the LOSG states that 95% of rainwater can be captured and percolated with LID, and the other 5% can be percolated with retention basins.

(See Cited Document 56.) In 2008 Keith Wimer, a member the LOSG, provided a conservative estimate of additional rainwater that could be captured and infiltrated with an LID recharge program (about 200 AFY). (See Cited Document 57, p. 11.) Capturing and infiltrating just 150 AFY of additional rain water would reduce the nitrate concentrations of basin recharge by 5-10%, based on estimates of the total recharge of the upper aquifer (1700 AFY per the 2003 Yates and Williams 2003 and 3000 AFY per the DEIR.) (See Cited Document 34, p. 19 and Cited Document 38, p. 24.) Therefore, a storm water management program by itself could reduce average nitrate levels in the basin to under the Regional Basin Plan objective of 10 mg/l. The cost of the program Mr. Wimer presented was under $10 million. (See Cited Document 57, p. 11.)

When CCRWQCB and County officials inaccurately claimed the LOWWP is essential for basin sustainability, they knew the project was not needed to not reduce seawater intrusion or prevent destruction of the basin by nitrates. They also knew that essential measures--conservation and shifts in pumping--could be implemented without the project. They further knew that the project has unmitigated impacts that increase the risk of seawater intrusion and threaten basin sustainability, and that management measures would address seawater intrusion, reduce nitrates, eliminate risks, and greatly reduce costs. CCRWQCB officials further knew the San Lorenzo Watershed plan provided an example of cost-effective comprehensive management that could achieve Regional Basin Plan objectives. However, agencies did not provide the information to the Commission.

I.E.2. Evidence the project will cause severe unmitigated adverse environmental impacts on the basin, Morro Bay National Estuary, and related environmentally sensitive habitat, public health and safety, and air quality/climate change.

I.E.2.a. Overview: The Commission's failure to mitigate resulted from inaccurate, erroneous, or incomplete information provided by agencies.

I.E.2.a i. The project EIR ignores and understates severe potential adverse impacts on vital resources, which the County and CCRWQCB intentionally withheld. The 3000-page LOWWP EIR fails to mitigate several severe potential adverse project impacts, including

- Adverse impacts on ESHA from a failure to mitigate impacts from reduced groundwater flows.
- Adverse impacts on the upper aquifer and lower aquifers from a failure to provide backup measures for Broderson leach fields (i.e., address liquefaction, delayed recharge, feasibility and uncertainty issues.)
- Adverse impacts on ground and surface water, habitat, and public health and safety from high salt content and contaminants in recycled water, the need for further costly, mitigation, and/or under use of the program (e.g., destruction of soils and aquifers, unmitigated seawater intrusion.)

- Adverse impacts on ground and surface water, habitat, and public health and safety from earthquakes (e.g., catastrophic failure of the collection system and/or the collapse of homes downhill from Broderson leach fields due to liquefaction).
- Adverse impacts on air quality/climate change from 8,000 metric tons of GHGs.

Rather than acknowledge severe unmitigated adverse impacts in the EIR--and provide the additional review and analysis needed to determine the least harmful feasible options/alternative--the County and CCRWQCB denied the problems and urged rapid approval of the project (to receive funding, to prevent further "harm" from septic systems, and/or to avoid CCRWQCB enforcement actions). The failure to disclose impacts—along with the inaccurate, erroneous, and incomplete information the County and CCRWQCB provided—resulted in the County Planning Commission and Coastal Commission attempting to mitigate for project impacts, but ultimately approving a project with severe unmitigated impacts. Neither the Planning Commission nor Coastal Commission was aware that project benefits had been exaggerated—and assumed the project would do more good than harm.

I.E.2.a ii. The County Planning Commission unsuccessfully attempted to mitigate for the project by adding 110 conditions to the CDP. Between February and December of 2009, the County Planning Commission added about 110 conditions to the project in approximately eight meetings, in an attempt to correct EIR flaws and omissions. To address unmitigated groundwater impacts on seawater intrusion and habitat, the Planning Commission eliminated spray fields and required all treated effluent to be returned to the basin. The Planning Commission retained Broderson leach field disposal as the main groundwater mitigation measure, but added other requirements: a recycled water condition (Condition 97), a conservation condition (Condition 99), a monitoring-and adaptive management condition (Condition 87), a plan to encourage homeowners to convert septic systems to rainwater catchment/recharge systems (Condition 88), a requirement to retrofit toilets, shower heads and faucets (Condition 108), and a requirement to install water meters in areas without meters (Condition 103). Nevertheless, in January 2010, the Coastal Commission agreed with appellants that the project did not avoid or minimize impacts on seawater intrusion and habitat, finding "substantial issue" with the project.

I.E.2.a iii. The County's response to Commission Staff questions regarding substantial issues provided inaccurate and incomplete information resulting in severe unmitigated project impacts. Shortly after the January Substantial Issue hearing, Commission Staff contacted the County requesting information as to how Conditions 87, 88, 97, 99, 103, and 108 provided specific, measureable, and enforceable mitigation for groundwater impacts. (See letter from Dan Carl, Central Coast Regional Manager, Cited Document 58, Exhibit 3, pp. 348-350.) Mark Hutchison, County Public Works Environmental Program Coordinator, responded with a letter, including 894 pages of text and attachments, much of it from the EIR. [See Cited Document 58, pp. 351-352 (letter) pp. 1- 894 (entire County response.)]

Mr. Hutchinson's response provided a good deal of inaccurate, erroneous, or incomplete information intended to downplay and withhold severe project impacts and risks, while exaggerating project

benefits. Some of the inaccurate/incomplete information in his response is underlined and explained below. A more complete discussion of the inaccurate/incomplete information is provided in Sections I.E.2.b and I.E.2.c.

> *"Hydrogeologic Impacts"* (See Cited Document 2, Exhibit 3, pp. 7-10)
>
> **(Referring to the EIR groundwater analysis in general.)** *…the manner in which the project will alter groundwater flows, with respect to short-term and long-term impacts, has received an extensive level of study, with a high level of specificity related to key issues of concern, such as wetlands and riparian areas, groundwater quality, water supply quantity, down-gradient effects of Broderson, and local water supply policies.* (Emphasis added) (p. 7)

Mr. Hutchinson's claim that project impacts received "… a high level of specificity related to key issues of concern, such as wetlands and riparian areas…(and) water supply quantity.." is not accurate. (See Cited Document 2, Exhibit 3, p. 7 and Page 50.) The EIR groundwater analysis was vague, inadequate, and seriously flawed. It found a 500 AFY reduction in flows to Willow Creek and a significant increase in liquefaction risks under homes downhill from the Broderson site to be "speculative." (See Sections I.E.2.b.i and I.E.2.f. for further discussion.) It failed to mention the adverse impacts and specific measures identified in the Condition 20 plan from the previous project, and DEIR failed to set specific objectives for water supply benefits from the project or contaminant reduction outcomes (See Cited Document 59.]

> *"Hydrogeologic Impacts"* (See Cited Document 2, Exhibit 3, pp. 7-10)
>
> **(Referring to an groundwater impacts on habitat, and adaptive management approach, and Condition 20 of the prior project)** *The LOCSD version of this plan has already been prepared and was approved by Commission staff in January 2005. Even though the analysis shows that substantial impacts are not expected to occur, the County has adopted the same approach and included the same requirements in the current project as condition #87. Given the results of the impact analysis, developing specific contingencies to respond to* ***unanticipated*** *wetlands changes would be speculative at this time. However, in conversations with the community, the County has identified three potential strategies to address wetlands changes, should they occur: 1) LID projects to capture stormwater and introduce (sic) back into the ground at strategic locations, 2) Further promote septic system leach filed (sic) conversions in strategic areas," and 3) Introduce recycled water into strategic locations via the projects (sic) backbone purple pipe system."* (Emphasis added) (pp. 8, 9)

The assertions that the Condition 20 plan from the prior project shows "…substantial impacts (to wetlands and other habitat) are not expected to occur" and wetland changes are "unanticipated" are

not accurate. This statement clearly shows Mr. Hutchinson intentionally provided inaccurate and incomplete information. The Condition 20 plans states:

> *Especially during the period after septic system decommissioning and before groundwater levels begin to stabilize in a state of equilibrium, the potential exists for adverse affects on the extent and composition of wetland resources in this area.* (Emphasis added.) (See Cited Document 3, p. 12 of pdf.)

Mr. Hutchinson also fails to state that the Condition 20 Plan identified significant potential impacts on Los Osos Creek, and made the mitigation of impacts on the steelhead habitat a focal point. (See Cited Document 3, p. 13.) Further, he does not mention that the Condition 20 Plan relied entirely on multiple, dispersed leach fields found to be infeasible for the LOWWP as stated in Topical Response 7 in the FEIR (See Cited Document 29, Topical Response 7, pp. 3-6 & 3-7.) The required harvest wells to prevent surfacing groundwater are specifically prohibited by the CDP. (See Cited Document 60, Exhibit B, Item 1J.) Finally, the LID and recycled water use measures he refers to, which "introduce" storm water and recycled water groundwater into "strategic locations", do not exist. They are not part of the project description and are not funded. As discussed, an effective LID (community storm water management) program will be unaffordable with the high cost of the project. Assuming Mr. Hutchinson is referring to Condition 88, a voluntary septic system conversion plan—the program is not measurable, enforceable, or necessarily feasible—and it will not be effective for technical reasons. (See discussion in Section I.E.2.d.v.)

"Hydrogeologic Impacts" (See Cited Document 2, Exhibit 3, pp. 7-10)

> **(Referring to seawater intrusion mitigation)** *In the short term…the collection of septic tank discharges is expected to have a potential adverse impact on the existing sea water intrusion in the lower aquifer. The project, as designed and conditioned, will provide more than a 3:1 mitigation of the potential sea water intrusion impacts and result in a beneficial groundwater impact. …The conservation and irrigation reuse programs will result in an immediate and guaranteed reduction in groundwater pumping, thereby ensuring at least 2:1 mitigation of potential sea water intrusion impacts.* (emphasis added) (p.9)
>
> **(Referring to Broderson Leach Fields)** *The extensive testing and analysis has led to a project description that avoids all potential adverse impacts from the Broderson leachfields, and is expected to provide multiple beneficial impacts*. (emphasis added) (p.10)

The project does not provide "more than a 3:1 mitigation of the potential seawater intrusion impacts and result in a beneficial groundwater impact" and certainly does not assure "…conservation and irrigation reuse programs will result in an immediate and guaranteed reduction in groundwater pumping…ensuring at least 2:1 mitigation of potential sea water intrusion impacts" (Emphasis added).

Conservation and recycling require the cooperation of water purveyors, farmers, and/or large urban water users, which is far from certain. Furthermore, recycled water use does not mitigate for seawater intrusion unless it is urban reuse or agricultural exchange—and the project does not specify those uses. For purveyors to be able to reduce pumping strategically to offset seawater intrusion requires cooperative nitrate treatment and intertie agreements. A CCRWQCB ISJ Update indicates cooperative treatment has been put on hold (See Cited Document 46, p. 2.) Further, the County provided water use estimates in June 2010 that significantly overstated use in the community. Therefore, at the time Mr. Hutchinson presented this information to the Commission, the potential mitigation from conservation on seawater intrusion was a fraction of what he states. (See Sections I.E.1.d.iii and I.E.2.d.iii. for further discussion.)

The claim that "The extensive testing and analysis has led to a project description that avoids all potential adverse impacts from the Broderson leach fields, and is expected to provide multiple beneficial impacts," is also clearly not accurate. The EIR fails to address or mitigate for earthquake impacts, delays in recharge, or to provide any back up measures for Broderson leach fields if disposal must be cut back or stopped. (Also see Sections I.E.2.c, and I.E.2.f.)

> *"Willow Creek Impacts"* (See Cited Document 2, Exhibit 3, pp. 16-17)
>
> **(Referring to an EIR water budget analysis showing groundwater outflows to Willow Creek riparian habitat from the perched aquifer dropping by 517 AFY with the project)** *A simple reading of the hydrologic budget tables in the EIR may result in concern for impacts to Willow Creek. However, the discussion in the analysis and an understanding of the source data demonstrate the following:*
>
> *The line item for Willow Creek outflow/evapotranspiration (OUT) is the total of all leftover groundwater which flows out of the perched aquifer under the analyzed conditions. The title includes "Willow Creek" because it is a major component of the outflows, but the outflows are a calculation of the excess groundwater for the entire 1,326 acre area of the perched aquifer. 2. The volume of excess groundwater that is lost from the groundwater basin is calculated after accounting for rainfall, runoff, evapotranspiration, irrigation, and evapotranspiration, residual potential evapotranspiration, and irrigation remain constant for both current conditions and project conditions. …4. Septic leachate is a significantly smaller source of perched aquifer input than rainfall and irrigation, and there is no evidence that groundwater levels will be significantly reduced in the area of Willow Creek, where shallow clay layers will maintain relatively high groundwater levels. The shallow depth of the clay layers is also evidenced by the existence of Eto Lake and two upstream ponds along Willow Creek. 5. It is clear from the documentation in the analysis that only a portion of the change in flows between the current conditions and project conditions, as a result of removing septic tank discharges, can be associated with Willow Creek. After project*

development there will continue to be excess groundwater in the perched aquifer that is transported out of the basin, including outflow to Willow Creek.

The comparison of aerial photographs from pre-development conditions is also a useful tool for predicting wetlands and riparian impacts. The attached figures show a comparison of pre-development (1949) and current conditions. The extent of wetland and riparian areas were much greater in pre-development conditions and demonstrate that the naturally occurring high groundwater levels in the perched aquifer are sufficient to support the existing habitat.

The Hydrogeological Impacts Study in the project EIR concludes that, while flow rates may be reduced, drainage will still occur in the Willow Creek area and that seasonal runoff and shallow groundwater are anticipated to provide sufficient water for use by the riparian vegetation established well before the Los Osos community was developed.

A secondary benefit of this condition (Bayridge Estates leach fields disposal of 33 AFY) is that it provides an additional level of protection for the Willow Creek drainage beyond that which was provided by the LOCSD project previously permitted by the Coastal Commission or that analyzed in the current project EIR, which found that there would not be any significant impacts to Willow Creek, even without the return of 33 AFY of recycled water to the Bayridge Estates leachfield.

Mr. Hutchinson refers to "excess" water and "lost" water, failing to point out that all groundwater in the area flows to and supports sensitive habitat, either the estuary or creeks (e.g., Los Creek Estuary). He further claims that there is "no evidence that groundwater levels will be significantly reduced in the area." However, Spencer Harris, the author of the hydrologic study used as the basis for EIR groundwater analysis, stated on June 30, 2009, at a County Planning Commission hearing that "…the subsurface outflow to the Willow Creek is anticipated to decline significantly by a few hundred acre feet. That's not seasonal run off—that's what's …surfacing from the septics… " (See Cited Document 61, also see Section I.E.2.b i.) Mr. Hutchinson also claims that "…naturally occurring high groundwater levels in the perched aquifer are sufficient to support the existing habitat." He does not mention that the Condition 20 plan reported that development lowered water tables until septic systems restored them. Finally, he indicates that the LOWWP mitigations provide more protection for Willow Creek than the prior project, but does not mention that the prior project had multiple leach fields and harvest wells that provided much more mitigation.

"Implementation Timing/ Water Conservation Program" (See Cited Document 2, Exhibit 3, pp. 251-257)

> **(Referring to County authority and basin sustainability)** *It is important to be aware that the Los Osos Wastewater Project has as its primary goal the elimination of water pollution from septic tanks. The focus of the project is compliance with the Regional Water Quality Control Board's discharge prohibition. By accomplishing this goal, the Project will remove a significant threat to water sustainability in Los Osos, and will remove a significant and ongoing source of environmental degradation.*
>
> *It must also be noted that without the wastewater project, and specifically the recovery and reuse of recycled water included in it, there is no possibility that Los Osos can solve its water supply issues, either now or in the future. Placing recycled water at the Broderson site, replacing groundwater pumping for irrigation with recycled water, and mandating interior plumbing retrofits are indispensible (sic) elements of Los Osos' water future that are provided by the wastewater project. In addition, technical studies completed by the wastewater project clearly show that imported water options are not financially feasible for the community; managing existing groundwater supplies is the only viable option.* (Emphasis added) (See Cited Document 2, Exhibit 3, p. 251)

Mr. Hutchinson's claims that the project "will remove a significant threat to water sustainability in Los Osos, and the community cannot solve its water supply issues without the project (especially the recycled water program) intentionally and substantially overstates the benefits of the project. As environmental coordinator responsible for the EIR, Mr. Hutchinson was aware that the EIR does not assert the project is essential to basin sustainability. He was also aware that conservation could be implemented without the project, and that a good deal of conservation had already occurred in the community without the project. He was further aware that Broderson leach fields would be tested for two years and were not sure to work, and he knew the project's recycling and conservation programs required purveyor and/or farmer cooperation, which was not guaranteed. Thus, he was aware that he provided inaccurate information, substantially overstating the potential benefits of the project. (See Section I.E.2.d.ii.)

I.E.2.a.iv. The final CDP (e.g., Special Condition 5 "The Los Osos Basin Groundwater Management Plan") fails to mitigate for adverse impacts and to protect resources, responding to inaccurate/incomplete information regarding project impacts and benefits. The Staff Report of May 27, 2010, adds Special Condition 5 in an attempt to mitigate adverse groundwater impacts and ensure the project supports basin sustainability. However, Condition 5 fails to require baseline assessments necessary to evaluate potential project impacts and determine appropriate mitigations. It further fails to provide specific, measureable, and enforceable mitigation measures and/or performance criteria. Thus, it does mitigate for project impacts, or even ensure mitigation measures are feasible—and it does not ensure the project will do more good than harm.

The failure of the condition to provide specific, measurable, and enforceable measures is clear by the underlined language in the following excerpts from Condition 5 of the Final CDP (See Cited Document 62 for full text.)

Condition 5 (See Cited Document 62).

Los Osos Basin Recycled Water Management Plan. *PRIOR TO CONSTRUCTION, the Permittee shall submit two copies of a Los Osos Basin Recycled Water Management Plan (Basin Plan) to the Executive Director for review and approval. The objective of the Basin Plan shall be to ensure that implementation of the project, including the sites designated for disposal of the treated effluent, is accomplished in a manner designed to maximize long-term ground and surface water and related resource (including wetlands, streams, creeks, lakes, riparian corridors, marshes, etc.) health and sustainability, including with respect to offsetting seawater intrusion* ***as much as possible****, within the Los Osos Groundwater Basin. The Basin Plan shall be structured so as to allow its programs* ***to be developed****, and any physical development underlying the implementation of such programs constructed, concurrent with construction of the approved project, and for it to be implemented concurrent with commencement of operation of the approved project. The Basin Plan may be structured to* ***allow phasing*** *if necessary to better achieve Basin Plan objectives. The Basin Plan shall include the following main components:*

a. Recycled Water Reuse Program. *As reflected in County condition 97, the Recycled Water Reuse Program shall ensure that all tertiary treated recycled water is disposed of in locations within the Los Osos Groundwater Basin that will maximize its ability to meet Basin Plan objectives, where the highest priority for reuse shall be replacing existing potable water use with recycled water use* ***where*** *feasible and* ***appropriate,*** *including with respect to both urban and agricultural reuse. The Reuse Program* ***may*** *include recycled water application at the Broderson leach field (not to exceed 448 afy on an average annual basis) and at the Bayridge leach field (approximately 33 afy or the amount shown to be necessary for maintaining Willow Creek and downstream resources in their pre-project state or better), but it shall prioritize beneficial reuse through (a) developing and installing recycled water connections and entering into delivery/use agreements with urban and agricultural property owners* ***as much as possible****, and (b) developing and installing other recycled water delivery systems, in both cases with a priority for locations where such beneficial reuse will go the furthest toward meeting Basin Plan goals.*

b. Water Conservation Program. …*The Permitee shall coordinate with water purveyors to the maximum extent feasible to integrate this conservation program with purveyor implemented outdoor water use reduction measures.*

c. Monitoring Program. *The Monitoring Program shall be designed to quantitatively and qualitatively assess the effectiveness of the Basin Plan over time to ensure its objectives are achieved, and shall include:* ***a baseline physical and ecological***

assessment of ground and surface water and related resources to be monitored; measurable goals and interim and long-term success criteria for those resources, including at a minimum clear criteria that demonstrate that the health and sustainability of Plan area resources are steadily improving over time, including with respect to seawater intrusion; *monitoring provisions, including identification of appropriate representative resource monitoring locations and data types (e.g., groundwater levels and quality; wetland, stream, creek, riparian, and marsh plant and animal abundance, hydrology, and water quality; etc.) and a schedule for proposed monitoring activities…*

d. Reporting and Adaptive Management Program. *… the annual reports shall be premised upon the concept of adaptive management that responds to information developed and effects better understood over time in association with the project, and is intended to allow for project changes covered by this CDP.*..(Emphasis added) (See Cited Document 62, pp. 9-11.)

As shown, the Condition 5 defers essential baseline assessments, specific performance criteria, and specific mitigation measures, including a range of specific measures to replace groundwater flows to habitat and the aquifers, e.g., if Broderson leach fields fail to perform. As a result, Condition 5 does not establish that measures are feasible or that mitigation for the project is possible. The County's failure to identify specific measures and performance criteria in the Draft Recycled Water Management Plan provides additional evidence that mitigation measures are not feasible, further showing the project will do more harm and good.

As shown in this request, the Commission's decision to attempt to mitigate for groundwater impacts with Condition 5, results from the County and CCWQCB's providing inaccurate, erroneous, and/or incomplete information. Both agencies understated and/or failed to disclose project impacts, while substantially exaggerating project benefits.

I.E.2.a.v. The final CDP fails to mitigate for project adverse impacts and to protect resources, responding to inaccurate/incomplete information regarding project loans. The County and CCRWQCB also encouraged the Commission to expedite approval of the project to obtain stimulus funding, apparently exaggerating the benefits of the funding. The Staff Report of May 27, 2010, clearly shows Commission Staff decided to recommended approval of the project without further evaluation of impacts ("data creation and analysis") responding to County claims that USDA "stimulus finds" would substantially lower homeowner project costs. These claims and other claims (e.g., that the project was urgently needed to protect resources) resulted in Staff's recommendation to set a June hearing date in Marina del Rey, rather than an August date in San Luis Obispo, although a citizen petition had been submitted requesting the hearing to be held in San Luis Obispo so more Los Osos residents could attend. (See Cited Document 1, pp. 2 & 3, 13.) The County apparently failed to inform Commission Staff that the $16 million grant of the USDA ARRA funding package was not guaranteed (See Footnote 1, p. 2

and Footnote 16, p.13.) The community received a $4 million grant as part of the $80 million loan. ARRA funds are loaned at 3.25% for 40-years, which reduces monthly payments for homeowners but does not reduce project costs—and could have increased costs (i.e., over costs with 30-year financing). ARRA funding also extends payments out beyond the life of some project components, so it could overlap funding for replacement costs. Furthermore, project funding was never in jeopardy. Had the ARRA loan been lost, an SRF funding package would have been available. The SWRCB and CCRWQCB are requiring the project, and the SWRCB has included a $6 million line item as repayment for a contested earlier SFR loan. Therefore, the SWRCB would have provided SRF funding for the entire project if necessary. It originally loaned about half of the funding at 2.6% for 30 years. The SWRCB can reduce interest rates down to 0%, and the State Board recently voted to reduce the Los Osos loan 2.0%. Neither the SRF nor the USDA ARRA loan covers on-lot hook-up costs. A very conservative estimate of these costs is between $3,000 and $10,000, which many property owners will have to finance. Total average property owner costs, with financed on lot costs, were estimated at about $240, and now are estimated at about $200, although some homeowners will pay $350 per month or more (e.g., families with higher hook up costs and/or larger families) because sewer rates are tied to water use. The LOSG is not aware of any loan package that would have reduced project costs by half as stated in the Commission Staff Report of May 27, 2010. Thus, evidence supports that, in addition to exaggerating project benefits, the County exaggerated the benefits of the loan package to the Commission, to expedite and obtain project approval.

I.E.2.b. The project will have severe adverse impacts on Morro Bay National Estuary and related habitat including Los Osos Creek, endangered steelhead habitat.

I.E.2.b i. The project will cut off groundwater flows to sensitive habitat, potentially reduce the size and viability of wetlands, and could reduce flows in Los Osos Creek, steelhead habitat.

The project has unmitigated impacts on Willow Creek Drainage and dependent habitat. The DEIR Groundwater Analysis shows that 517 AFY of groundwater will stop flowing to Willow Creek Drainage, a mile-long stretch of riparian wetland in the eastern part of the urban area (outside of the prohibition zone), which supplies flows to Willow Creek, ETO Lake, and Los Osos Creek. (See Cited Document 38, p. 25-26; Cited Document 39, pp. 1, 4, 5.)

Despite acknowledging that the project will reduce the water in the perched aquifer (Zone A) and flows to the habitat, the EIR claims impacts are "speculative:"

> *Implementation of the proposed project would reduce septic effluent discharge into the perched aquifer (Zone A). Therefore, the project would reduce the quantity of groundwater within the perched aquifer. However, the exact quantity of reduction within the perched aquifer (while estimated) is unknown, and the potential impact on groundwater flow to*

surrounding surface water features is speculative given that the amount of perched groundwater currently flowing to surface water features is not known. (Emphasis added) (See Cited Document 38, p. 43 & 44 or Cited Document 9.)

On June 30, 2009, County Planning Commissioners interviewed Spencer Harris, author of the hydrogeologic study providing the basis for the DEIR Groundwater Analysis (See Cited Document 38), and asked him what would happen to Willow Creek Drainage with project implementation. Mr. Harris responded as follows:

> *…the subsurface outflow to the Willow Creek is anticipated to decline significantly by a few hundred acre feet. That's not seasonal run off—that's what's …surfacing from the septics…If you look at historically what has developed, what naturally grew there like the oaks and whatever was present before large scale development took place in town…There will be a certain amount of drying up—yes—and you'd be reverting back to what would be predevelopment type conditions."* (Emphasis added) (See Cited Document 61.)

When asked how to avoid harm to these wetlands and other aquatic habitat along the estuary, Mr. Harris said the best solution is drain fields or leach fields located near the habitat, and he referred to the dispersed leach field disposal system of the prior project. The LOWWP does not provide dispersed leach fields. (See Condition 20 discussion below.) When Mr. Harris finished speaking, Sarah Christie, Chair of the Planning Commission, pointed out that the Coastal Act requires protection of wetlands regardless of whether wetlands have resulted from development (septic systems). (See County Planning Commission meeting video, 1:50:00 to 2:30:00 of the meeting, June 30, 2009, SLO County Website.)

Thus, Spencer Harris, the consultant primarily responsible for determining the groundwater impacts and mitigation measures for the LOWWP, provided the Planning Commission an estimate of the amount of reduction in ground water flows "several hundred acre feet." He also identified substantial potential adverse impacts to wetlands from reductions in flows. Mr. Harris's estimates are consistent with the estimates we provide based on current water use and project wastewater flows (317 AFY of reduced flows to all habitat and 150 to 250 to Los Osos Creek). (See Section I.E.2.j., Table 2.)

The Planning Commission did not require multiple leach fields to address these adverse impacts, but instead added Condition 87 (CDP Condition 20 from the prior project) providing for a groundwater monitoring and adaptive management plan. It also added Condition 88 (an education program encouraging homeowners to direct roof-top rainwater to abandoned septic systems—part of CDP Condition 20), and Condition 101 (requiring 33 AFY of recycled water to be disposed at Bayridge Estates leach fields located several blocks uphill and to the south of Willow Creek).

However, project conditions clearly do not mitigate for potential impacts on Willow Creek Drainage and dependent sensitive habitat—and County and CCWQCB officials knew they did not. Condition 102 (33 AFY of disposal at Bayridge Estates leach fields) obviously does not mitigate for the removal of "several hundred acre feet" of groundwater flow, even if all the water disposed at the site flows to Willow Creek Drainage. Condition 88 does not mitigate for flows because the program is voluntary, and most water running off roofs and other hardscape within the urban already percolates to groundwater, according to the 2003 Yates and Williams study. (See Cited Document 34, p. 7.) Condition 87 does not mitigate for impacts on the habitat because specific adaptive management measures to replace flows are not feasible. This is shown by the Condition 20 plan for the previous project. (See Cited Document 3, pp. 12 & 13 of pdf. Also see Section I.E.2.d.v.)

The Condition 20 Management Plan from the previous project shows the LOWWP does not mitigate for adverse impacts on protected habitat and endangered species, including steelhead, within the National Estuary-State Marine Reserve ecosystem, including Los Osos Creek and Los Osos Creek Estuary. The *Los Osos Wastewater Treatment Groundwater Level Monitoring and Management Plan,* developed by the LOCSD to comply with CDP Condition 20 of the prior project (submitted to the Commission on January 19, 2005) clearly shows that the LOWWP does not mitigate for impacts on area wetlands and other environmentally sensitive aquatic habitat (Sweet Spring, Pecho Marsh, 3rd Street Marsh, Baywood Point Springs, Baywood Marsh, Eto Lake, Los Osos Creek, Osos Creek Wetlands). Much of this habitat is part of the National Estuary and buffers it from harmful run off, where the Estuary is also designated a State Marine Reserve. Therefore, the habitat receives the highest level of protection afforded marine environments under state and federal law, in part because it is habitat for federally-listed endangered steelhead, as well as for other protected plant and animal species, e.g., salt marsh bird's beak, California sea-blite, red-legged frog, and southwestern pond turtle. (See Cited Document 3, pp. 12-17.)

The Condition 20 Management Plan states that groundwater levels will drop initially when septic systems are eliminated then begin to rise about 18 months later. The Plan also estimates 320,000 gallons per day (360 AFY) of treated effluent must be disposed in leach fields east of South Bay Boulevard to mitigate for reduced flows to Los Osos Creek, Los Osos Creek Estuary, and other ESHA in the area. The Plan explains that a "sizable" portion of groundwater from septic systems within the prohibition zone flows east to this habitat from a "mound" of higher groundwater in the perched aquifer under 15th and Pismo Streets. (See Cited Document 3, p. 13 and Cited Document 33, p. 5.) This eastward movement of groundwater is well documented in basin studies, including the 2005 Seawater Intrusion Assessment. (See Cited Document 37, p. 12.) Finally, the Plan bases its entire mitigation strategy on the disposal of treated effluent in multiple leach fields, dispersed around the urban area, which require harvest wells to ensure effluent does not surface jeopardizing health and safety. (See Cited Document 3, e.g., p. 7.) However, the FEIR confirms these leach fields are infeasible for this project, and the CDP specifically prohibits harvest wells.

The FEIR confirms that multiple leach fields are not included in the present project because they are not feasible:

> *Other disposal options include potential leachfield sites within the community, as evidenced by the project the LOCSD proposed in 2001. However, these urban leachfields require the use of multiple street rights of ways to install leach lines, leading to on-going high maintenance costs and concerns about the long-term effects of leachfields in the urban area. Together with Broderson, these sites, could not accommodate the entire expected flows, leaving a substantial volume (over one-third) of the effluent needing disposal. A key project requirement is redundancy, including providing for an alternate disposal area outside of the urban area in the unlikely event that for any reason in-town disposal is not usable in either the long or short term. Alternate in-town disposal sites would not meet this redundancy goal, in addition to being unable to accommodate all of the flows.* (See Cited Document 29, p. 3-6, 3-7)

One reason leach fields and harvest wells are not feasible, which the FEIR fails to mention, is that California Department of Public Health (CDPH) has prohibited harvest wells for this project. A letter from John Waddell, County Project Management, to Kurt Souza of the CDPH explains that use of harvest wells would make the project a "recharge" project, rather than a "disposal" project, requiring more expensive reverse osmosis treatment. (See Cited Document 71.) As a result, harvest wells are specifically prohibited in the CDP (See Cited Document 60, Exhibit B, Item 1J). Reverse osmosis has significant adverse impacts, including a substantial amount of brine production/disposal; thus, it would require additional environmental review. It is also economically infeasible with the very high cost of the LOWWP.

The Condition 20 plan states groundwater levels will drop at first, then begin to rise and stabilize within 18-months to two years. This drop in water tables will be longer and more severe with the LOWWP because the project does not provide multiple leach field disposal over a wide area for relatively rapid vertical recharge. Recharge will be centralized, almost entirely at the Broderson site, resulting in much slower lateral recharge. The CSUMB Watershed Institute indicates vertical recharge to groundwater at the Broderson site will take only three months, while lateral movement of the water will take 20 years, just to reach the large pumping depression in the upper aquifer under downtown Los Osos (See Section I.E.2.c.ii.) Also, Broderson leach field disposal will be tested at half capacity for two years and may need to be cut back or stopped due to salt build up or liquefaction. (See Section I.E.2.c.iv.)

Eugene Yates, a foremost expert on the basin, also confirms the project will not mitigate for impacts on sensitive habitat:

> *The wastewater project's Draft Environmental Impact Report presented a biological analysis that overlooked one of the largest potential impacts, which is a substantial reduction in groundwater discharge to Willow Creek and wetlands in the Los Osos Creek estuary and*

along the Morro Bay shoreline (Michael Brandman Associates 2008). ….As a result of the proposed sewering, the septic system percolation decreases to 36 AFY and outflow to streamflow and riparian ET decreases to 35 AFY (a 93% reduction). Sewering would similarly decrease upper aquifer outflow to marshes around the perimeter of the urban area. If this impact is eventually evaluated and deemed to significantly impact Morro Bay shoulderband snail, steelhead trout or other sensitive species or habitats, some form of mitigation will be necessary. (Emphasis added) (See Cited Document 36, p.4).

Condition 5 does not mitigate for these impacts because it does not identify specific, measurable, enforceable, and feasible measures to restore flows. The monitoring and adaptive management programs provided in the County Draft Recycled Water Management Plan identify "leach fields and harvest wells" and "artificial watering" as possible specific measures, both of which are not feasible. Artificial watering is not possible because use of potable water will further adversely impact the critical seawater intrusion problem. (Also see Sections I.E.2.d.iv and I.E.2.d.v.) Thus, habitat such as Baywood Marsh and Los Osos Creek Wetlands (steelhead habitat) are likely to be harmed by the project, along with Willow and Los Osos Creeks.

Condition 5 of the Final CDP fails to mitigate for impacts on protected habitat because the recycling program won't provide enough water to replace flows to habitat.

Special Condition 5, the "Los Osos Basin Recycled Water Management Plan," of the Final CDP states:

The objective of the Basin Plan shall be to ensure that implementation of the project, including the sites designated for disposal of the treated effluent, is accomplished in a manner designed to maximize long-term ground and surface water and related resource (including wetlands, streams, creeks, lakes, riparian corridors, marshes, etc.) health and sustainability, including with respect to offsetting seawater intrusion as much as possible, within the Los Osos Groundwater Basin. (Emphasis added.) (See Cited Document 62)

Special Condition 5a, the "Recycled Water Reuse Program," states:

As reflected in County condition 97, the Recycled Water Reuse Program shall ensure that all tertiary treated recycled water is disposed of in locations within the Los Osos Groundwater Basin that will maximize its ability to meet Basin Plan objectives, where the highest priority for reuse shall be replacing existing potable water use with recycled water use where feasible and appropriate, including with respect to both urban and agricultural reuse. The Reuse Program may include recycled water application at the Broderson leach field (not to exceed 448 afy on an average annual basis) and at the Bayridge leach field (approximately 33 afy or the amount shown to be necessary for maintaining Willow Creek and downstream resources in their pre-project state or better), but it shall prioritize beneficial reuse through (a) developing and installing recycled water connections and entering into delivery/use

agreements with urban and agricultural property owners as much as possible, and (b) developing and installing other recycled water delivery systems, in both cases with a priority for locations where such beneficial reuse will go the furthest toward meeting Basin Plan goals. (Emphasis added) (See Cited Document 62, p. 9.)

Condition 97, incorporated into Condition 5, requires at least 10% of recycled water to go to "environmental reservations" and 10% to go to agriculture (70-80 AFY each), and it states "Highest priority shall be given to replacing potable water uses with tertiary treated effluent consistent with Water Code Section 13550." (See Cited Document 60, p. 6 of pdf).

With 448 AFY of recycled water disposed at Broderson leach fields, 250-300 AFY is available for urban/agricultural reuse and habitat mitigation. This assumes about 750 AFY initial wastewater flows. [The Commission Staff report of May 27, 2010, estimates 700 AFY flows initially, and the County Draft Recycled Water Management Plan of November 2011 estimates about 780 AFY (.7 mgd). (See Cited Document 1, p. 59, and Cited Document 70, pp. 4&5)]

The sole source of recharge to the basin is from the surface (including rain, irrigation and septic system return flows) and all groundwater not pumped for beneficial uses flows downhill to sensitive aquatic habitat along the estuary or to Willow Creek, Los Osos Creek, and Eto Lake in the eastern part of the urban area. Thus 100% of treated effluent (all water removed with the project) is needed to mitigate for impacts on the basin and habitat (i.e., the estuary, wetlands, marshes, springs, creeks, and Eto Lake). The prior project recognized this fact and provided for all effluent to be returned and dispersed around the urban area where it was removed. Even with the dispersal of all the effluent close to where it was removed, the Condition 20 plan states that "artificial" watering of wetlands could be necessary (See Cited Document 3, p. 15.)

The LOWWP does not return all treated effluent to the urban area, nor identify a feasible means to replace/maintain groundwater flows and aquifer recharge. The County Draft Recycled Water Plan shows at least 160 AFY going to agricultural reuse sites east of Los Osos Creek. This effectively exports water from the basin because it provides no habitat mitigation and almost no seawater intrusion mitigation. The Recycled Water Plan inaccurately states agricultural reuse meets the requirements of the CDP (i.e., prioritizes seawater intrusion mitigation) (See Cited Document 70, p. 28.) For agricultural reuse to provide significant seawater intrusion mitigation, the reuse must be agricultural exchange, which returns agricultural well water to the urban area to offset pumping. (See Section I.E.2.d.)

The Draft Recycling Plan also shows 42 AFY of recycled water going to schools within the urban area, with another 80 to 95 AFY potentially going to Sea Pines Golf Course and the cemetery (30 to 45 AFY to the golf course and 50 AFY to the cemetery). None of these uses provides significant flows to habitat (See Cited Document 70, p. 5. and Section I.E.2.d.)

Assuming the County commits to supplying 30-50 AFY of recycled water to either Sea Pines Golf Course or the cemetery, only 50-70 AFY of recycled water (750 AFY minus 680-700 AFY) will be available to

replace flows to habitat. Condition 101 provides 33 AFY of disposal at Bayridge Estates to support Willow Creek Drainage, which leaves 17 to 37 AFY of recycled water. Thus, at most, just 70 AFY of recycled water is available to mitigate for adverse impacts on all aquatic habitat. This is not nearly enough to replace flows, even if baseline monitoring indicates current flows to Willow Creek Drainage are only half the 517 AFY (i.e., the amount the DEIR indicates will stop flowing to the habitat). (See Cited Document 38, pp. 24 & 25, or Cited Document 39, pp. 4 & 5.)

A conservative estimate is that between 270 AFY and 320 AFY of water will be needed to replace groundwater flows to sensitive habitat, with at least 150 AFY needed for Los Osos Creek. (See Section I.E.2.j., Table 2.) As Eugene Yates points out, Broderson leach fields not only fail to supply flows to Willow Creek Drainage, but also to habitat along the estuary. Moreover, the Condition 20 plan and CSUMB Watershed Institute confirm that any benefit from Broderson leach fields will be delayed for a minimum of 18 months and possibly 20 years or more. Therefore, replacement water will be needed to supply all ESHA—even the resources expected to receive flows from Broderson. Replacement water would be needed permanently if Broderson disposal fails or must be cut back significantly. (Note that our estimate of the replacement flows, 317 AFY, assumes Broderson leach fields work perfectly; we estimate 750 AFY of water would be needed if Broderson doesn't work or is not feasible--see Section I.E.2.j. Table 2.)

The County *Draft Recycled Water Management Plan* reports that recycling contracts with farmers and large urban customers will be finalized prior to project start up and remain in effect 5-10 years. (See Cited Document 70, p. 29.) This confirms that at least 160 AFY of treated effluent from the project will be removed from the urban area and not available for habitat mitigation. The recycled water plan also indicates the commitment to schools will be 42 AFY. These commitments do not allow adequate water for habitat (See Cited Document 70, p. 29.) Thus, habitat mitigation--if it occurs at all—will require at least 200 AFY of potable water, using conservative estimates. Use of potable water for replacing flows to habitat will significantly adversely impact basin balance and seawater intrusion, as confirmed by Eugene Yates (See Cited Document 36, p. 4.)

Mr. Hutchinson states that the County will increase agricultural reuse as backup for Broderson leach fields. (See response to Coastal Commission Staff, March of 2010—I.E.2.a.ii.). This might solve the problem of where to dispose of all the treated effluent, but agricultural reuse only reduces water available for habitat. Similarly, if recycled water is diverted from Broderson leach fields for habitat, the potential benefit of the Broderson disposal is reduced.

A recycling program, by definition, provides no net increase in the water supply. At best, it restores a large percentage of the water removed with a wastewater project, with the opportunity to improve efficiency some. However—as shown by the evidence we provide—mitigation measures for habitat are not more efficient, and not likely to be feasible. Septic systems--the current recycling program—provide the most efficient recycling system, and very likely the only feasible way to maintain habitat at current levels.

Inflow and infiltration (I/I) into the collection system will increase wastewater flows and the amount of recycled water available for various uses, but it will not increase the amount available for habitat because I/I reduces groundwater flows/recharge.

The LOSG presented scenarios in which the basin could potentially be balanced and habitat maintained with the LOWWP, but the scenarios assumed different mitigation measures, different basin conditions, and much more mitigation potential from conservation (See Cited Document 2, Exhibit 4, pp. 88, 89.) When we presented the scenarios in early 2010, we recommended 100% agricultural "exchange" and a community-wide storm water management (low impact development--LID) to enhance rainwater recharge in basin-wide. Condition 88, which provides for the County to encourage property owners to convert septic systems to infiltration systems, does not provide a net benefit in groundwater recharge. It is also clear to us now that agricultural exchange is not feasible due to the poor quality of LOWWP recycled water quality (high salt content) and the substantial costs and adverse impacts required to improve it. Also, the high cost of the LOWWP precludes a community LID program. Residents will not be able to pay for it. Further, we—like the Commission—were not provided accurate water use numbers and assumed more conservation was possible to mitigate for the project—and we did know seawater intrusion had accelerated (by 12 times) at the same time the community had reduced water use by over 30%. Finally, we were not aware the project provided no discernible benefits to the estuary or that Broderson impacts (liquefaction and recharge delays) were not mitigated. Finally, we have always recommended a comprehensive management solution, with a phased, decentralized approach, including basin-wide septic system management, as the most sustainable alternative.

County officials knew impacts on sensitive habitat were unmitigated, but provided inaccurate, erroneous, and incomplete information to Commission Staff to obtain project approval. Mark Hutchinson (County Environmental Program Manager for the project) was familiar with the Condition 20 mitigation plan from prior project and referred to it in his response to staff regarding substantial issues. (See Cited Document 2, Exhibit 3, p. 17 and Section I.E.2.a.III.) County officials were also present during Spencer Harris' testimony before the Planning Commission on June 30, 2009, in which Mr. Harris states that "several hundred feet" of groundwater will stop flowing to Willow Creek.

Nevertheless, Mr. Hutchinson does not mention Mr. Harris's statement in is response to Commission Staff on February 26, 2010, or the potential impacts to habitat identified in the Condition 20 plan (e.g., to Los Osos Creek) (See Cited Document 2, Exhibit 3, pp. 240-241 or 894, and Cited Document 3.) Instead he states, "…there is no evidence that groundwater levels will be significantly reduced in the area of Willow Creek," adding that Bayridge leach field disposal "…provides an additional level of protection for the Willow Creek drainage beyond that which was provided by the LOCSD project previously permitted by the Coastal Commission." (See Cited Document 2, p. 17.) These statements clearly misrepresent the project's potential impacts to habitat. Mr. Hutchinson also characterizes the groundwater flows as "lost" to the basin, implying that they do not support EHSA, and he claims ample water will remain in the perched aquifer to maintain wetlands at a level similar to conditions in 1949 (See Cited Document 2, Exhibit 3, pp. 16 & 17 and Section I.E.2.III.) He neglects to mention that the

1949 photograph depicts a period before wetlands "decreased significantly due to urbanization," per the Condition 20 plan. (See Cited Document 3, p. 3.)

The CCRWQCB also knew the project would have significant adverse impacts on environmentally sensitive habitat, but said nothing. CCRWQCB officials are familiar with the EIR, prior Los Osos project, and basin studies (e.g., 2005 Seawater Intrusion Assessment), so they know that septic systems support ESHA along the estuary, and removing the sources of recharge could harm that habitat. Officials are also aware the prior project provided leach fields and harvest wells, in part to maintain groundwater flows to EHSA, including Los Osos Creek. They further knew that the prior project (Condition 20 plan) identified potential harm to habitat from delayed recharge, even though the project had multiple leach fields. By virtue of their backgrounds, expertise, and experience, CCRWQCB officials know that water levels will drop with Broderson disposal reducing groundwater flows potentially adversely affecting habitat. Roger Briggs, in his DEIR comments, points out that Broderson disposal could be cut back due to adverse impacts on soils or the water supply. (See Section I.E.2.c.iv., also Cited Document 13, p. 3 & 4.) CCRWQCB officials are further aware that these sensitive habitats are not adversely affected by septic systems now and the project will not benefit them--as evidenced by statements in the WDR (See Cited Document 11, p. 5). However, Count and Water Board officials did not inform the Commission of these facts.

I.E.2.b ii. Drying of wetlands will cause pollutant levels to rise in sensitive aquatic habitat, including the National Estuary and Los Osos Creek. As mentioned above, Spencer Harris and Eugene Yates, two of the foremost experts on the basin, have stated that the project will have adverse impacts on wetlands. However, the EIR fails to disclose these impacts or discuss them. Part of that discussion would be the potential adverse impacts on surface waters from reduced wetlands in the area. One of the main, generally acknowledged, benefits of wetlands is their ability to buffer surface water from the adverse effects of contaminants in surface run off and groundwater. This important function of Willow Creek Drainage and bayside wetlands could be reduced by the project, causing contaminant levels to rise in the estuary and creeks, resulting in such problems as algae blooms along the estuary fringe and harm to aquatic life. The CCRWQCB and County officials are aware that wetlands significantly reduce pollutant levels in sensitive surface waters, by virtue of their professional backgrounds and expertise. The CCRWQCB is also aware that the 2009 San Lorenzo Watershed Plan reports that riparian wetlands along the river substantially reduce nitrates in the river. (See Cited Document 16, p. 3-60.)

I.E.2.c. The project will have severe adverse impacts on the basin water supply, substantially reducing chances for basin sustainability, and defeating a major purpose for the project as stated in Resolution 83-13, to increase the beneficial use of the basin.

I.E.2.c.i. The project will adversely impact the shallow water supply. The EIR and 2003 Yates and Williams study show the LOWWP will substantially lower water levels in the upper-most water bearing zone of the basin, Zone A (the perched aquifer). The EIR indicates recharge to the aquifer (which extends over more than half the urban area) will be reduced by almost half (630 AFY of 1367 AFY). (See Cited Document 38, p. 24 or Cited Document 39, p. 4.) The EIR also clearly states the project will not mitigate for impacts on Zone A with statements such as: "Implementation of the proposed project would reduce septic effluent discharge into the perched aquifer (Zone A.) Therefore, the project would reduce the quantity of groundwater within the perched aquifer." (See Cited Document 38, pp. 43 & 44 or Cited Document 39, p. 9.)

Thus, any private wells tapping this water source, mostly on larger lots outside of the prohibition zone, would potentially be significantly adversely affected. The 2005 Seawater Intrusion Assessment identifies the location of most Zone A wells, estimating the average amount of water pumped from Zones A and B between 1985 and 2001 at 40 AFY. (See Cited Document 37, Figure 7 & p. 7.) Failure to notify these property owners of potential adverse impacts to their wells is one reason the LOWWP CDP for the LOWWP should be revoked. (See Part III).

Water purveyors are also considering use of shallow zones to supply water for irrigation as a way to offset pumping of the lower aquifer to address the critical seawater intrusion problem. (See Cited Document 47, p. 5.) The project will most likely prevent this use.

In addition, the project will most likely adversely affect wells tapping Zone B (the transitional zone). The EIR claims Zones B and C are "virtually restored to current conditions" with the LOWWP (i.e., Broderson leach field disposal). (See Cited Document 38, pp. 40, 43.) However, the Yates and Williams study, which provides the foundation for DEIR studies, indicates Zone B (Layer 1) will drop 10 feet and completely dry up in places. (See Cited Document 34, p. 18.) Moreover, the 2003 study assumes greater recharge of Zones A and B—i.e., 100% of the treated effluent returned and disposed in leach fields spread throughout the urban area. Therefore, the DEIR lacks credibility in the finding that Broderson leach fields will avoid impacts to the upper aquifers Zones B & C--especially as it applies to the parts of Zones B and/or C located some distance from Broderson site. The DEIR (Appendix C of D-2, Cited Document 38) shows that water tables drop 5 feet in parts of the upper aquifer; thus, the DEIR is inconsistent (See Cited Document 38, p. 40.)

Zones A and B are also likely to be adversely affected by disposal of treated effluent and recycled water for irrigation. Roger Briggs, Executive Officer of the CCRWQCB, points out that recycled water can pollute and even destroy aquifers and soils due to salt build up (See Cited Document 13, pp. 4 & 5, also see Section I.E.2.c.iv. below for Roger Briggs quote and further discussion.)

Therefore, the project reduces the beneficial use of Zones A and B, defeating a major purpose for the project per Resolution 83-13 (i.e., increased beneficial use of the shallow aquifers). (See Cited Document 19, p. 000456.) Ironically, the project will also adversely impact the shallow nitrate

monitoring wells used to justify the project, including the test wells used for the 2006 monitoring study cited in the WDR. (See Cited Document 11, p. 4.) Most of these wells tap Zone A and may even dry up. (See Cited Document 32, p. 2.) These facts clearly show that the project does not mitigate for impacts on the shallow water supply, and they provide an important reason the EIR, CDP, and LOWWP—driven by Resolution 83-13—are flawed. (Also see Section I.E.3.a.)

The County and CCRWQCB are aware of potential impacts on the upper zones by virtue of their familiarity with the EIR, basin studies, and basin hydrology—and by virtue of their professional backgrounds, experience, and expertise. They are also aware that these adverse impacts undermine the purpose for the project per Resolution 83-13. However, they did not inform the Commission of these crucial facts.

I.E.2.c.ii. The project will adversely impact the upper aquifer community water supply.

The project fails to mitigate for substantial adverse project impacts on the upper aquifer (Zone C). The project is supposed to increase the beneficial use of this aquifer, but instead it threatens beneficial use of the aquifer by causing water levels to drop and making the upper aquifer vulnerable to seawater intrusion. Adverse impacts are not mitigated in three main ways: 1) the project does not mitigate for delayed recharge (the time difference between relatively rapid vertical recharge and much slower lateral recharge), 2) the project does not mitigate for planned major increases in pumping from the aquifers, and 3) the recycling program and other proposed measures do not mitigate for adverse impacts.

(Also see Sections I.E.2.c.iv., and I.E.2.d. for unmitigated impacts on the upper aquifer.)

Project impacts are not mitigated because the project does not mitigate for substantial initial drops in water tables. Although the EIR claims the project maintains water levels in the upper aquifer (Zone C), the Condition 20 plan for prior project reports that water levels in the "upper aquifer" drop substantially as septic systems are decommissioned, which will occur over about a one-year period. (See Cited Document 3, pp. 3, 10, 11 of pdf.) The Plan states the drop in water levels will be about 18 months before effluent disposal begins to restore water levels. Thus, even with greater amount of recharge provided with the prior project (all treated effluent returned and percolated) and more direct (vertical) recharge from multiple disperse leach fields, the prior project was predicted to cause a decline in water tables for 18 months.

The LOWWP has centralized recharge (one main source at Broderson), it percolates only about two-thirds of the effluent removed (if it works perfectly), and the leach fields will be tested at less than half capacity for two years. Thus, water table levels in the upper aquifer with the LOWWP will remain lower for a longer period of time causing greater potential adverse impacts on well production and seawater intrusion (See Cited Document 64.)

According to the 2005 Seawater Intrusion Assessment, the upper aquifer is only "relatively stable," subject to seawater intrusion during droughts (when water tables drop). The study indicates that outflows to the ocean from the aquifer must be maintained 5 feet above sea level to avoid seawater intrusion. (See Cited Document 37, p. 27.) Eugene Yates explains that even a temporary drop in water levels can harm aquifers because seawater intrusion advances rapidly when water levels decline, but does not retreat at the same rate when levels are restored. (See Cited Document 36, pp. 3 & 4.)

The CSU Monterey Bay (CSUMB) Watershed Institute report (*Can the Los Osos Valley Groundwater Basin Provide a Sustainable Water Supply?* January 2010) indicates drops in upper aquifer water levels will be slower than the Condition 20 plan states, but restoration of levels will take much longer. Noting that water percolates vertically much faster than horizontally, the study states:

> *At the proposed Broderson site, percolation to the water table is estimated to be three months but then travel time to downtown takes twenty years (Table 5), so there will be lag time between current geographically dispersed septic recharge and planned point recharge in the system. The transition period, when the recharge system is equilibrating may be a time of saltwater intrusion in the upper aquifer* (Emphasis added). (See Cited Document 67, pp. 32 & 33.)

The CSUMB report further states:

> *The capacity of the upper aquifer to resist sea water intrusion across the face of the sea water-aquifer interface under the conditions that will exist when the LOWWP is implemented are uncertain. One source of uncertainty is how lateral water flow in the upper aquifer will be impacted when it receives a greater portion of water from a single location (the Broderson site) rather than from dispersed sites (septic systems). It is feasible that a change in flow dynamics could cause more outflow along part of the interface and less outflow along other parts, thereby increasing the possibility of saltwater intrusion in reduced flow areas.* (See Cited Document 67, p. 60.)

The above evidence shows that water levels could drop substantially for 20 years or more in the upper aquifer. The EIR did not report or address this impact although it is undoubtedly a fact known to County and CCRWQCB officials based on their familiarity with the Condition 20 report and/or by virtue of their professional backgrounds and expertise. These facts support that project impacts on the upper aquifer are not mitigated, the project could cause seawater intrusion, and/or adversely impact well production--and officials did not disclose the impacts.

Adverse impacts are not mitigated because the project does not address substantially increased pumping from the upper aquifer. Purveyor plans to shift most pumping to the upper aquifer and inland substantially increase the potential for the project to cause seawater intrusion and other adverse impacts on the upper aquifer. Purveyors plan to increase production in Zone C by 400-500 AFY to relieve pumping of the lower aquifer and address seawater intrusion. (This is an estimate, based on the

2009 Urban Yield tech memo and LOCSD utility reports, adjusting for substantially reduced water use since 2009. The 2009 Urban Yield tech memo recommended about a 1000 AFY shift.) (See Cited Document 45, Table 1.)

This major shift in pumping will occur at the same time the project removes about 750 AFY of septic system recharge to the urban basin, of which about 400 AFY recharges the upper aquifer. (This is based on estimated project flows from the Draft Recycled Water Plan and the percentage of flows recharging the upper aquifer per the DEIR, i.e., 600 to 800 AFY of about 1200 AFY total recharge—see Cited Document 38, p. 24). Thus, the project, in conjunction with increased pumping, will effectively remove 750-800 AFY of water from the upper aquifer, with just 448 AFY of treated effluent from Broderson leach fields replacing it (if the leach fields work perfectly). Therefore, the project in conjunction with more pumping from the upper aquifer, results in a net loss of water in Zone C of 300-350 AFY. If Broderson leach fields don't work or are not feasible the net loss would be 750 AFY. (See Section I.E.2.j., Table 1.)

According to the July 2009 Basin Yield tech memo prepared for the ISJ Working Group by Cleath-Harris Geologists, Inc., outflows from the aquifer (an indicator of water levels) will be reduced by 400 AFY (from about 1300 AFY now to about 900 AFY) (See Cited Document 74, p. 6 or Balance Charts, Cited Document 40, pp. 1, 3, 4; also see Cited Document 38, Balance Charts or Cited Document 39, p. 3.) A reduction in outflows of 400 AFY represents about a 30% reduction in estimated outflows. Even if modeled outflows today are less than modeled outflows in 2008 and 2009, water tables and outflows will drop significantly based on this evidence, making the upper aquifer wells vulnerable to seawater intrusion.

Furthermore, shifts in pumping may have to be greater to stop seawater intrusion. The 2009 Basin Yield tech memo does not identify a safe yield for the lower aquifer which stops seawater intrusion; it identifies a "sustainable yield" that allows seawater intrusion to continue. Purveyors are expected to cut back on pumping when chloride levels rise to 250 mg/l in supply wells, the point at which water is not recommended for drinking. (See Cited Document 74, p. 6.)

In his January 2010 of review of the Urban Yield memo (2009), Eugene Yates confirms that the shifts proposed may not be adequate, and in his June-August 2010 review of the Basin Update he cautions that major shifts could cause seawater intrusion in the upper aquifer, in combination with the project. (See Cited Document 36, p. 2, and Cited Document 35, pp. 2 & 4.) He states

> *Sewering will greatly decrease recharge to the upper aquifer at the same time municipal pumping from the upper aquifer will be increasing to minimize seawater intrusion. These two major changes are a huge shift in the upper aquifer water balance and could cause seawater intrusion in that aquifer (p. 2)*
>
> *The arrival of seawater intrusion at the center of pumping in the lower aquifer will force purveyors to shift a large percentage of municipal pumping from the lower aquifer to the upper aquifer. This would move the seawater intrusion problem from the lower aquifer to*

the upper aquifer. It also means that the "mitigation factors" used to evaluate the effect of wastewater alternatives on lower aquifer intrusion are not as relevant. The water balance and intrusion risk in the upper aquifer will be as important as in the lower aquifer, if not more so. For example, the effectiveness of percolation from the Broderson leach fields for mitigating upper aquifer intrusion is greater than for the lower aquifer, but new problems arise because the localized nature of Broderson recharge and increased upper aquifer pumping could result in seawater intrusion. (Emphasis added) (p.4)

Thus, the combined (or cumulative) effects of major changes in the recharge regime of the basin (dispersed to centralized recharge) and major changes in pumping regimes (the doubling of production with major changes in pumping locations) will substantially increase the potential for adverse project effects on the aquifer, including the potential for seawater intrusion. When these impacts are added to the adverse impacts on water levels due to delays in recharge, the potential cumulative impacts on the upper are clearly substantial (i.e., a net loss of 750 from the upper aquifer). The adverse impacts will potentially cause seawater intrusion, adverse effects on wells, and reduced flows to habitat, which the EIR did not address. The fact that the unmitigated impacts could cause purveyors to continue to over pump the lower aquifer (indirect impacts) have also not been addressed. (See further discussion in Section I.E.2.e.i.)

It should be noted that the very high levels of conservation since 2008 are likely to be having some effect on the upper aquifer currently and could already be causing seawater intrusion. **Monitoring and assessment of the current seawater intrusion progress and nitrate levels should be provided to the Commission to determine the state of the basin.**

Adverse impacts on the upper aquifer are not mitigated because the project recycling program and other mitigations do not mitigate for impacts. As discussed in Section I.E.2.b.i., the County Draft Recycling Plan does not provide ample water for habitat. Likewise, it fails to provide ample water to offset project impacts on the upper aquifer, especially if Broderson leach fields fail and/or the agricultural reuse program is expanded. The Sea Pines Golf Course at 35-40 AFY is the only site identified in the Draft Recycling Plan that will potentially reduce pumping from the upper aquifer. (See Cited Document 70, p. 5.) Forty acre feet is not nearly enough to offset the 300 to 750 deficit created by shifts in pumping in conjunction with the project. As explained in Sections I.E.2.d.iii. & I.E.2.e.ii., the conservation program also does not offset these deficits, so impacts are not mitigated.

(Also see Sections I.E.2.c.iv., and I.E.2.d. for a further discussion of unmitigated impacts on the upper aquifer.)

Prior to the Coastal Commission hearing of June 2010, County and CCRWQCB officials were aware of the following: 1) water tables are predicted to drop significantly before Broderson disposal restores levels, 2) the upper aquifer is only "relatively" stable and outflows must be maintained to avoid seawater intrusion, 3) Broderson leach fields will be tested at less than half capacity and may have to

be cut back or stopped, 4) the recycled water program may not be feasible and offsets almost no pumping from the upper aquifer, 5) major shifts in pumping can cause seawater intrusion in the upper aquifer, and 6) the EIR does not address these potential adverse impacts. Although County and CCRWQCB officials were aware of these facts prior to CDP approval, they not did inform the Commission.

I.E.2.c.iii. The project will adversely impact the lower aquifer community water supply.

The project will adversely impact the lower aquifer water supply (Zones D and E) making seawater intrusion worse and threatening the water supply for three reasons: 1) It will add severe adverse impacts and uncertainties to a condition already extremely difficult to mitigate, 2) mitigation measures are not specific, measureable, or enforceable--and may not be feasible, and 3) Indirect, cumulative, and socio-economic adverse impacts are not mitigated. (Also see Sections I.E.2.c.iv., I.E.2.d., and I.E.2.e. for further discussion of unmitigated impacts on the lower aquifer.)

The project will adversely impact seawater intrusion because it adds severe adverse impacts and substantial uncertainties to a condition already extremely difficult to mitigate.

The 2005 Seawater intrusion Assessment conveys the seriousness of the problem in the Executive Summary:

> *Sea water intrusion is **threatening** the lower aquifer, which is the **primary water supply** for the community. Based on the findings and conclusions of this project, it is recommended that: 1) Lower aquifer ground water production be reduced to a level which does not exceed the average annual fresh water recharge to the aquifer. Reductions should be focused primarily on the west side of the basin, where active intrusion is occurring. 2) A basin ground water management plan be configured to mitigate sea water intrusion as a **top priority**, such as outlined in the July 2005 Draft Water Management Plan for the Los Osos Valley Ground Water Basin (Cleath & Associates). This plan contains a phased approach to basin management, whereby increased utilization of the upper aquifer for ground water supply allows lower aquifer recovery from the excessive draft currently being placed upon it. 3) A sea water intrusion monitoring program be implemented to provide information on the future movement of sea water and the success of mitigation measures. The recommended monitoring program is included in Part 2 of this document. (Emphasis added) (See Cited Document 37, p. ES-4.)*

The 2005 study highlights the severity of the problem by explaining that aquifer levels (equivalent pressures) must be 9 to 17.5 feet above sea level in the lower aquifers (Zones D and E) to repel seawater. Large sections of the lower aquifers, however, are currently 5 to 10 feet below sea level. Therefore, levels must be brought up 14 to 27 feet under much of the Los Osos Community, in order to stop or reverse the problem. This large "pumping depression" is the result of 30 years of over pumping

the basin, and it will require major reductions in pumping over many years to remedy. (See Cited Document 37, pp. ES-2 and Figure 5.)

The 2009 Urban Yield tech memo recommends purveyors reduce pumping in the lower aquifer to about 500 AFY from about 1200 AFY, shifting the majority of pumping to the upper aquifer (about 1000 AFY). (See Cited Documents 35, p. 6 and 74.) (The amount of shifting currently needed could be less with the considerable reduction is water use due to conservation since 2004—see Section I.E.2.j., Table 1.)

According to Eugene Yates, even the major shifts in pumping recommended in the 2009 Urban Yield memo may not stop seawater intrusion, requiring further shifts in pumping. (See Cited Document 36, p. 3.) Mr. Yates warns that the "sustainable yield" identified in the 2009 memo does not provide the margin of safety needed to stop seawater intrusion with modeling uncertainties—and he highlights the risk seawater intrusion poses to the Los Osos water supply:

> *Saltwater intrusion can severely affect Los Osos basin water quality, which presently is the sole source of potable water in the basin. Intrusion requires years to decades to reverse and remediate. Therefore, any prudent water management plan must include margins of safety that consider the uncertainty in estimated basin yield, monitoring and an adaptive management strategy that includes contingency actions* <u>*that can be implemented*</u> *should the proposed plan not work.* (Emphasis added) (See Cited Document 36, e.g., pp. 4 &5.)

In December of 2009, the CSUMB Watershed Institute expressed similar dire warnings about the dangers of seawater intrusion recommending that basin yield estimates "err on the side of caution," and that County and purveyors have well-thought-out adaptive management measures in place <u>ready to apply</u>. The Institute also recommended an integrated comprehensive basin-wide management program, emphasizing conservation, storm water management (LID recharge), and beneficial reuse to "stop or reverse seawater intrusion as soon as possible." The Institute said the goal should be to avoid adaptive management if possible with preventative measures, in order to avoid "…outside sources of water or a desalination facility," which it says "should be considered last resorts." (See Cited Document 67, pp. 67 & 68.)

Mr. Yates and the Watershed Institute expressed these very serious concerns about the threat of seawater intrusion to the basin even before the release of the *Los Osos Groundwater Basin Update* (See Cited Document 47) in May of 2010. The Basin Update confirmed that seawater intrusion is moving 12 times faster than the EIR and 2005 Seawater Intrusion Assessment estimated (700 feet per year rather 45-60 feet per year). The Basin Update shows the salt-water front advanced twice as far in four years (2005-2009) as in the previous 20 years (1985-2005). (Cited Document 47, Exhibit B) In those four years, seawater contaminated about 15,000 acre feet of water, a five years' supply for the entire Los Osos area including farms.

Chloride levels (an indicator of seawater intrusion) at the Palisades well--one of the main community supply wells located in the center of the community—climbed from 60 mg/l in 2002 to 360 mg/l in

December 2009/January 2010. (See Cited Document 47, Exhibit B). Water is not recommended for drinking at 250 mg/l and not drinkable at 500 mg/l per Title 22 standards. The Palisades Well supplies about half of the water the LOCSD delivers and about one-fourth of the water for the entire urban area of Los Osos based on a 2002 report. (See Cited Document 72, p. 3 of pdf.)

In his June 2010 review of the Basin Update (His review was updated in August of 2010.), Eugene Yates states:

> ***The seawater intrusion problem is extremely urgent.*** *Seawater intrusion moved over a half mile in four years and has reached the center of municipal pumping from the lower aquifer. As I stated in my previous review (February 4) seawater intrusion is very difficult to reverse and renders water unusable for drinking when it exceeds only 1.5% of the inflow to a well. The most recent intrusion data indicate seawater intrusion is accelerating and threatens to shut down (or is already shutting down) the community's largest production wells.* (Emphasis added.) (See Cited Document 35, p. 1.)

In the June-August review, Mr. Yates recommends immediate shifts in pumping to the upper aquifer and 500 AFY of conservation, as the quickest and most effective measures to address the "extremely urgent" seawater intrusion problem. He states:

> ***Two immediate actions are needed to protect the water supply and prevent further intrusion.*** *Both actions can be implemented quickly (1-2 years), and both actions are mutually compatible:*
>
> ***Shift most of the municipal pumping up from the lower to the upper aquifer system, and/or shift some of the municipal pumping farther inland.*** *This requires drilling new wells and laying more pipeline.*
>
> - *This action may not be sufficient to provide long-term protection against seawater intrusion because the basin has never experienced that much upper-zone pumping, particularly in the absence of septic system recharge.*
>
> ***Decrease average per-capita water residential use from 104 gallons per capita per day (gpcd) to 74 gpcd or lower.*** *This latter level is reasonable since it is the current average for the City of San Luis Obispo.*
>
> - *This action provides more reliable long-term protection against seawater intrusion because it addresses the fundamental problem which is an overall imbalance in the water budget (i.e., more water is consumed in the basin than is being replenished). This would reduce total water production in the basin by about 500 AFY, which provides a reasonable margin of safety given the uncertainty in previous studies (simulated intrusion rates) and uncertainties in the effects of currently proposed projects (shifting large amounts of pumping from the lower to upper aquifer; the percolation capacity of the Broderson leach fields).* (Emphasis added) (See Cited Document 35, pp. 1 & 2.)

Mr. Yates also recommends updated "studies…to reflect the current project description and current status of seawater intrusion," and he states that the project should be "…designed to help solve the seawater intrusion problem as part of an integrated water management plan for the Los Osos Basin." He suggests placing the emphasis on "…conservation…agricultural exchange and storm water management…." (See Cited Document 35, pp. 3 & 4.) Thus, he recommends major shifts in pumping and maximizing pumping offsets with conservation and recycling. However--as we point out in several sections of this Request--project conservation and recycling programs will not provide significant seawater intrusion mitigation. For one thing, ag exchange is not a viable option because farmers will not exchange well water for LOWWP recycled water (which is much higher in salts due to seawater intrusion). (See Sections I.E.1.d.iii, I.E.2.d. ii, I.E.2.d.iii, I.E.2.e.ii, and I.E.2.j.Tables 1 & 2.)

When Mr. Yates wrote his review—like the Commission—he did not know that more than 400 AFY of conservation had occurred since about 2008. He was using the water use estimates from the ISJ 2009 Urban Yield tech memos (Cleath-Harris Geologists, Inc.) which assumed average use (demand) to be 2043 AFY between 2004 and 2008; whereas, use was closer to 1600 AFY in 2010 based on LOCSD water use data. (See Cited Documents 74 & 78.) Even with the major reductions in pumping (a total of 600-700 AFY since 2004) seawater intrusion had moved rapidly through the lower aquifer. The most recent chloride tests at the Palisades Well in May 2011 show seawater intrusion continues to rapidly degrade the aquifer even with a further decline in water use. Chlorides climbed to 398 mg/l from 360 mg/l in January of 2010 with purveyors pumping between 1400 and 1500 AFY. (See Cited Document 77, p. 5.)

Thus, conservation—which is the most effective and direct way to stop the progress of seawater intrusion—has not had a discernible effect on the problem. This confirms that seawater intrusion in the Los Osos basin will be extremely difficult to stop--even without project impacts. Further, the mitigation potential from conservation is a fraction of what it was thought to be in June 2010.

Mr. Yates explains why the basin model did not accurately predict the advance of seawater intrusion and why conservation has not produced a discernible benefit, pointing out that the basin model is not a good tool for estimating the simulated rate of seawater intrusion because it does not account for "heterogeneity." He explains "… (water moves through the aquifer along preferred flow paths within sand lenses) that is not represented at the scale of the model." He further explains that the rapid advance of seawater intrusion is caused by "unsustainably low onshore groundwater levels," and he refers to the large pumping trough in the center of Los Osos, adding

> *Seawater will tend to move into this trough until water levels are brought up, which is why pumping must be reduced drastically in the lower aquifers (by approximately 1000 AFY according to model simulations [Cleath-Harris Geologists, 2009]) as soon as possible.* (See Cited Document 35, p. 6.)

The very large pumping trough, as mentioned, extends under much of the community and results from well use that is still occurring (e.g., the Palisades Well). It even extends inland to some of the wells purveyors will be relying on to slow seawater intrusion (e.g., the South Bay Well) further showing that stopping seawater intrusion will be extremely difficult. (See Cited Document 37, Figure 5.)

Mr. Yates presented his review almost 18 months ago. Although purveyors have shifted some pumping to the upper aquifer and inland (per the CCRWQCB ISJ Update, December 2011), the shifts have been modest, not nearly at the level Mr. Yates and the 2009 Urban Yield memo recommend. (See Cited Documents 46, pp. 3 & 4.)

Further, the studies Mr. Yates recommends to "reflect the current project description and current status of seawater intrusion" were never done—nor has seawater intrusion been tracked in other wells. When the LOSG obtained the chloride data for the Palisades well, we were told chloride data is not being collected for other LOCSD wells.

In March and May of 2011, the LOSG supported Citizens for a Sustainable Community (CSC) requests to the CCRWQCB and SWRCB for a subsequent EIR (SEIR) to evaluate and mitigate the changed status of seawater intrusion (i.e. the more substantial and severe potential adverse impacts from accelerating intrusion, including the cumulative and socio-economic impacts of planned purveyor actions). However, the CCRWQCB and SWRCB denied the CSC requests (also an LOSG appeal of the WDR to the SWRCB in June of 2011). As a result, the very serious adverse impacts associated with accelerating seawater intrusion remain unmitigated. (See Section I.E.2.e.)

The above information (and information we provide in other sections of this Request) provides clear evidence that accelerating seawater intrusion threatens the viability of the basin water supply substantially increasing the potential adverse impacts from the project. It also shows agencies were aware of these increased impacts in June of 2010 but failed to inform the Commission. This combination of increasingly severe impacts and denial of the impacts could lead to the loss of the resource. (Also see Sections I.E.2.c.iv., I.E.2.e.iii., and I.E.2.1. for discussions of cumulative and socio economic impacts, uncertainties associated with Broderson recharge, and the County and CCRWQCB's failure to commit to project mitigation and basin sustainability.)

The project will adversely impact seawater intrusion because mitigation measures are not measurable or enforceable. Seawater intrusion is accelerating and not responding to significantly reduced pumping since 2004. (See LOCSD 2010 water use and Section I.E.2.j., Table 1.) Therefore, establishing a baseline for seawater intrusion and setting measurable and enforceable performance criteria for project mitigation measures may be impossible. The effects of Broderson leach fields on seawater intrusion are not measurable due to the high level of uncertainty associated with the measure (See Section I.E.2.c.iv.below.) Further, the benefits of conservation, the most direct and effective measure to reduce seawater intrusion, are not certain or measurable because 1) specific reductions from an indoor-only program cannot be measured accurately, 2) purveyors are not certain to reduce pumping where it reduces seawater intrusion, and 3) the County has not been willing to implement a

comprehensive basin-wide plan and ordinance to stop seawater intrusion with specific, measurable, and enforceable measures.

Peter Mayer, a nationally-recognized authority on conservation, reviewed the ISJ draft conservation plan for the LOSG in December of 2011. Mr. Mayer is a partner in AquaCraft of Boulder Colorado, which recently completed a comprehensive study of California water use. He confirms that an indoor-only conservation program is not measurable, also pointing out that monitoring and management of all water use within the basin (including private well use) is necessary to effectively manage seawater intrusion. (See Cited Document 75, pp. 3 & 4.) Eugene Yates reinforces this point in his January 2010 review, stating that non-metered private well use adds significant uncertainty to basin management. (See Cited Document 36, p.3.) In 2009, in a letter to the County Planning Commission, from Golden State Water Company confirmed that conservation does not ensure seawater mitigation, which requires purveyor to reduce pumping in wells causing seawater intrusion. (See Cited Document 73, pp. 2 & 3.) Purveyors do not currently have all the agreements in place or infrastructure to adjust pumping as needed because. Furthermore, purveyors are not bound by the CDP, and they will not set measurable and enforceable objectives for stopping seawater intrusion in the ISJ "Basin Plan." Effective mitigation of seawater intrusion requires the County to implement a comprehensive basin-wide program and ordinance with specific, measurable, enforceable objectives, but the County has been unwilling to do so. (See further discussion in Sections I.E.2.i, and I.E.3.g .)

Basically, the County will not be held to any standard with regard to project impacts on seawater intrusion or ESHA--just as it will not be held to any standard for project benefits. The project could make the extremely urgent seawater intrusion problem worse or cause nitrate levels to rise in the basin, and there would be no enforceable remedy. The lack of specific, measurable, and enforceable mitigation confirms that the project is not mitigated. (Also see Sections I.E.2.a.iv., I.E.2.c.iv., I.E.2.d and I.E.2.1. for further discussion of the unenforceability of proposed mitigation measures.)

The project will have adverse impacts on the lower aquifer and basin due to indirect, cumulative, and socio-economic impacts. One indirect impact the project will have (and is having) is that it is diverting limited resources away from the urgent seawater intrusion problem. Considerable time and resources to project development that could be going to the water quality issue posing a threat to the basin. The nitrate issue does not pose a threat to the basin. (See Section I.E.1.d.)

To effectively address the critical seawater intrusion problem in Los Osos requires focusing resources and management efforts on the issue, maximizing measures with the greatest likelihood of success (e.g., conservation and shifts in pumping), while minimizing measures with potential adverse consequences. The project, instead, requires focusing resources on costly, complex, and risky mitigation programs. The need to mitigate potentially severe impacts highlights another indirect impact--the project makes basin planning much more complex and difficult. The project has potential adverse impacts that may not show up for years; therefore, it will make basin planning more difficult for years. After 30 years of septic system use, current conditions are known and predictable. Basin

systems are stable (except for seawater intrusion). With the project systems will require another 30 years or more to stabilize.

Another indirect project impact is the effect the project has (and is likely to have in the future) on the ISJ purveyor basin planning process and purveyor actions. Purveyors were supposed to agree on a water management plan by December of 2009. While the reason for the delay have not been made public, it is reasonable to assume purveyors have concerns about project impacts and are reluctant to commit resources to specific strategies (e.g., relocating wells) because adverse impacts on the upper aquifer and inland parts of the basin are not mitigated.

The very high cost of the project will cause socio-economic impacts. The costs will make funding seawater intrusion mitigations (e.g., monitoring, adaptive measures, and purveyor management measures) much more difficult. As a result, needed measures will be delayed and less likely to happen. Both purveyors and citizens will be less likely to pursue and/or fund pumping changes, nitrate treatment, and outdoor conservation—all necessary measures to address seawater intrusion.

The current project focuses a tremendous amount of resources on elevated nitrates in the upper aquifer, which do not threaten basin sustainability, risking the basin (the sole water supply for Los Osos). County and CCRWQCB officials know and understand the threat the project poses to the lower aquifer and basin, how difficult seawater intrusion will be to reverse, and the inadequacy of mitigations to address the "extremely urgent" problem—but they did not inform the Commission.

I.E.2.c.iv. Broderson leach field disposal, the main groundwater mitigation measure, does not mitigate for project impacts on the basin or habitat and could be infeasible. Broderson leach field disposal is the project's main mitigation measure for adverse project impacts on the basin and habitat, including adverse impacts on seawater intrusion. However, it will not mitigate for severe potential impacts on these resources for three reasons: 1) the measure has unmitigated adverse impacts that will most likely require it to be cut back or shut down. (The County plans to test the measure for two years at less than half capacity to make sure they don't destabilize soil under homes or pollute the upper aquifer—see Cited Document 64.) 2) The measure will not replace groundwater flows removed with septic systems to the aquifers or habitat. 3) The measure does not provide specific, measureable, or enforceable mitigation benefits.

<u>Broderson disposal has unmitigated adverse impacts that will require leach field operation to be cut back or shut down.</u> The EIR states that the leach fields will be tested for two years to ensure they don't cause groundwater to surface and/or threats to water quality from mounding groundwater. (See Cited Document 64.) However, the measure's potential to cause liquefaction downhill from the site has not been mitigated. (See discussion of unmitigated earthquake impacts in Section I.E.2.f.). Further, the measure could cause salt build up in the aquifer and other water quality issues and/or daylighting of water downhill, yet Broderson disposal has no back up—and evidence shows feasible back is not possible.

In his DEIR comments, Roger Briggs, Executive Officer of the CCRWQCB, expresses concern about Broderson causing liquefaction:

> *The DElR explains that monitoring changes in groundwater levels down gradient of the Broderson site will assure that any changes "will remain less than significant." However, the DElR fails to present a mitigation plan describing the best methods to respond to incremental changes in groundwater levels that would allow for continued safe use of the disposal fields relative to potential destabilizing the hillside below the Broderson site, increasing liquefaction potential or limiting the amount of unsaturated soil available for effluent treatment.*
>
> *The DElR does not to provide discussion on mitigation for disposal design for Waste Water Treatment Plant Operations should monitoring data show that changes in the groundwater levels require a decreased disposal rate for the Broderson site. The EIR states that monitoring will occur to determine if the Broderson site could safely increase the level of disposal operations. However, no discussion is presented to state how the plant operations will be conducted if the Broderson site disposal rates must be decreased due to destabilization of the hillside below the disposal site. Since the Broderson site is a critical component of all four project alternatives, and because it needs to be designed to accept disposal year-round, including during the rainy season, the County should explain how disposal operations will be affected and what potential options will be available to replace any required reduction in disposal levels at Broderson.*
>
> *Water Board staff will evaluate the County's waste discharge application to ensure compliance with Basin Plan design criteria, siting criteria, disposal monitoring, and associated operations and management procedures for the proposed the (sic) Broderson site leach field system. Staff will consider incorporating requirements that are specific to the design and management of the proposed disposal system (See Mr. Briggs letter, Pages 4 & 5, on the County LOWWP website* Cited Document 29*, pp. 3-42 to 3-43.)*

The County's response to Mr. Brigg's, and others with similar concerns is that the leach fields 1) have been tested, 2) more water can go to spray fields, 3) 46 AFY of recycled water storage allows some adjusting in disposal rates, 4) 160 AFY of conservation over 20 years provides a margin of safety, and 5) other leach fields can be installed. This response does not address unmitigated potential earthquake impacts (See Section I.E.2.f.) or explain how the current project addresses the particular issue Mr. Briggs raises: What happens if Broderson disposal must be cut back or stopped? Spray fields have been eliminated, 46 AFY of storage allows only a temporary reduction in disposal (not enough capacity to dispose of treated effluent), other leach fields are not feasible, and conservation and recycling programs will not offset the mitigation Broderson is supposed to provide.

Therefore, the project has severe unmitigated potential adverse impacts on basin and habitat because the main mitigation measure could be infeasible or not work—and no feasible back up measures have been identified.

Broderson disposal will not mitigate adverse groundwater impacts because it does not replace groundwater flows removed with septic systems. The project is supposed to replace the benefits of 750 AFY of septic system recharge with 448 AFY of water disposed at the Broderson site and 33 AFY disposed at the Bayridge Estates site. As discussed in Section I.E.2.b.i., the project would need to return all effluent to the urban area and dispose the effluent near where it is removed to have a chance of doing this. Theoretically, water levels in the upper aquifer and lower aquifers could be maintained/restored by offsetting pumping from the aquifers, but project conservation and recycling programs provide only a fraction of the offset needed. (See Sections I.E.1.d.III, I.E.2.d. ii, and I.E.2.d. iii.) The EIR acknowledges the project fails to replace flows in the shallow aquifers (i.e., about half the recharge). Eugene Yates points out the Broderson disposal does not restore flows to sensitive habitat along the estuary and major shifts in pumping to the upper aquifer-- needed to address the urgent seawater intrusion problem--could cause water levels to drop and seawater intrusion in the aquifer. The Condition 20 plan for the prior project states that water tables in the upper aquifer will drop substantially for 18 months (even with twice as much water percolated at Broderson and all treated effluent returned via dispersed leach fields), and the CSUMB Watershed Institute states that Broderson recharge doesn't benefit some parts the upper aquifer for 20 years or more—and does not benefit part of the lower for over 300 years (see below). Thus, despite official claims, the Broderson does not replace flows and maintain aquifer levels, which results in significant unmitigated potential adverse impacts all aquifers and all sensitive aquatic habitat in the area. (See Sections I.E.2.c.i through I.E.2.c.iii for further discussion.)

Broderson disposal does not mitigate for impacts because its benefits are not measureable or enforceable due to substantial uncertainties. The benefits of Broderson disposal on the basin (upper and lower aquifers) is based on hydrogeological modeling, which has substantial levels of uncertainty. Eugene Yates, one of the creators of the basin model, points out several sources of uncertainty in his January 2010 review of the 2009 ISJ Urban Yield Technical Memorandum (See Cited Document 36 and Cited Document 74.) In that review and his later June-August 2010 review, Mr. Yates states that the basin model is not a good tool for predicting seawater intrusion progress. (See Cited Document 35, p. 6.) This fact is clearly shown by the fact that the 2005 Seawater intrusion Assessment underestimated the rate of seawater intrusion progress by 12 times. The study estimated it was moving 45-60 feet per year (1985 to 2005) when it actually moved 700 feet per year (2005 to 2009). (See Cited Document 47, Exhibit B). The Basin Update indicates that seawater intrusion "extended into the lower aquifer through 'fingers' as well as a broader front." (See Cited Document 47, p. 3.)

Mr. Yates further points out that major shifts in pumping to the upper aquifer add uncertainty to modeling predictions because the shifts "deviate substantially" from the conditions used to calibrate the model. (See Cited Document 36, p. 2.)

The CSUMB Watershed Institute concurs with Mr. Yates that substantial uncertainty exists in the model, as well as with the potential for Broderson disposal to mitigate for adverse project impacts on seawater intrusion and habitat. The Institute highlights the uncertainty of lower aquifer recharge,

raising questions about the permeability of the regional aquitard (a 50 feet clay layer separating the upper and lower aquifers). (See below.)

The EIR and County and CCRWQCB officials inaccurately assert that 448 AFY of treated effluent disposed at the Broderson site will mitigate for seawater intrusion in the lower aquifer—i.e., all treated effluent disposed at the site will percolate to the upper aquifer and 99 AFY of that will leak to the lower aquifer repelling seawater intrusion. The "99 AFY" fails to disclose the uncertainty of the model and other factors related to Broderson recharge. In fact, Broderson disposal may provide no benefit at all to the lower aquifer and seawater intrusion. The 2005 Seawater Intrusion Assessment, which provides the scientific basis for Broderson, is much more circumspect:

> *Plans originally developed during the 1980's for treated effluent disposal at higher elevations on the west side of the basin provide a reasonable potential for incidental recharge to the lower aquifer (Emphasis added). (See Cited Document 37, p. ES-3.)*

The uncertainties of upper aquifer recharge, discussed above are compounded with lower aquifer recharge, and include 1) the distance to the lower aquifers 200-700 feet, 2) basin geology--many scattered clay lenses and thicker clay layers separating aquifers, 3) the unknown hydraulic properties of the regional aquitard (which averages 50 feet in thickness) separating upper and lower aquifers, and 4) the geologic timescales required for water to move to the lower aquifer (hundreds of years.)

The CSU Monterey Bay Watershed Institute estimates it takes 171 years for water to permeate the regional aquitard (referred to as the AT2 aquitard) and 302 years for water disposed at the Broderson site to move to the large pumping depression under the downtown area of the basin where seawater intrusion is occurring. (See Cited Document 67, pp. 32-34.)

Based on age dating and constituent analyses of lower aquifer water, as well as previous modeling, the 2005 Seawater Intrusion Assessment concludes that most of the recharge from the lower aquifer is from the upper. Based on the study and modeling, the DEIR estimates that 448 AFY disposed at Broderson leach fields will result in 99 AFY of water in the upper aquifer to leak to the lower aquifer. Given the many unknowns, this estimate has a high level of uncertainty and is misleading. For one thing, the specific pathways and mechanisms of lower aquifer recharge are not known--e.g., whether movement is from leakage through the aquitard, through a gap in the aquitard, or by seepage via well shafts. The 2005 Seawater Intrusion Assessment acknowledges that the "hydraulic parameters of the clay (regional aquitard) have not been measured directly." (See Cited Document 37, p. 8.) Thus, Broderson disposal may not recharge the lower aquifer at all, depending on the particular properties and characteristics of the basin downhill from the Broderson site.

Referring to the question of the hydraulic parameters (i.e., the permeability of the regional aquitard) the CSUMB report states:

> *Testing should be done to resolve this question as the vertical permeability of the aquitard is key to estimating recharge potential and safe yields for the lower aquifer. It is worth noting*

that conservation and other water management strategies that reduce the pumping from the lower aquifer will have the most direct and immediate benefits on the lower aquifer, as recharge from the surface is very slow and the benefits are uncertain. (See Cited Document 67, 34.)

A peer review of the basin model prepared for purveyors, included in the *Los Osos Groundwater Basin Update* (as Exhibit C; Cited Document 47), does not establish that Broderson leach fields will mitigate for impacts on seawater intrusion or other groundwater impacts. A peer review of the 2009 Urban Yield tech memos and basin model (See Cited Document 47, Exhibit C) appears to contradict Mr. Yates and the CSUMB Watershed Institute statements/conclusions that the basin model and project mitigation measures (including Broderson leach fields) have substantial uncertainty levels. In his peer review of the 2009 tech memos, Peter Pyle of Stetson Engineers, states "The current SEAWAT model and results regarding seawater intrusion and safe yield provides (sic) usable results on which to base near-term changes in pumping distribution to mitigate seawater intrusion." However, when Mr. Pyle makes this statement in May of 2010, he is not in possession of information (e.g., Exhibit B of the Basin Update) showing seawater intrusion is moving 12 times faster than the model predicted. He further does not have Mr. Yates' January review of the model, listing specific sources of uncertainty in the model.

Mr. Pyle bases his conclusions on the 2009 Urban Yield memos, the 2008 DEIR hydrologic analysis, and the 2005 Seawater Intrusion Assessment—published prior to the Basin Update. (See Cited Document 47, Exhibit C, p. 2, 3, 6, 8 & 9.) Even without the 2010 Update, Mr. Pyle stresses in his review that Cleath-Harris should state uncertainty values for the model and he recommends upgrades to the model. He further suggests (although the statement is unclear due to typographical errors) that the difference between what the model predicts and actual seawater intrusion should be used for determining management options (See Cited Document 47, Exhibit C, p.8). Also, his review does not specifically analyze project mitigations or potential impacts, so it does not consider the adequacy of mitigations. The review, therefore, does not provide substantial evidence that the project mitigates for impacts on seawater intrusion or the basin.

Adding to Broderson leach field uncertainties is the fact that the County and CCRWQCB have not committed to ensuring Broderson leach fields and other project mitigation provide a measurable and enforceable benefit. (See Sections I.E.2.i and I.E.3.g.)

For the reasons stated above (and in other sections of this Request) Broderson leach field disposal—the main groundwater mitigation measure for the project—does not mitigate for the project, and the project has substantial unmitigated potential impacts on the basin and sensitive habitat.. County and CCRWQCB officials knew the above facts prior to June of 2010. Nonetheless, County officials inaccurately claimed that Broderson disposal—with other measures—fully mitigate for impacts provide a net benefit on seawater intrusion. (See Section I.E.2.a iii.) CCRWQCB officials also knew impacts

were not mitigated, e.g., because the project did not provide a back for Broderson leach fields. However, these officials failed to inform the Commission.

I.E.2.d. The Draft Recycled Water Management Plan (RWMP), which the County prepared to comply with CDP Special Condition 5 (a-d), fails to mitigate for the project and provides further evidence that mitigation is not feasible.

I.E.2.d.i Overview. The County prepared the Draft *Recycled Water Management Plan* (RWMP) to comply with Special Condition 5. The plan includes four programs: the "Recycled Water Reuse Program" (Condition 5a), "Conservation Program" (Condition 5b), "Monitoring Program" (Condition 5c), and a "Reporting and Adaptive Management Program" (Condition 5d). (See Cited Document 62, pp. 9 & 10.) Condition 5 incorporates and supersedes other groundwater-related measures in the CDP and has the goal of ensuring overall groundwater/habitat improvements. The objective of Condition 5 is

> *"…to ensure that implementation of the project, including the sites designated for disposal of the treated effluent, is accomplished in a manner designed to maximize long-term ground and surface water and related resource (including wetlands, streams, creeks, lakes, riparian corridors, marshes, etc.) health and sustainability, including with respect to offsetting seawater intrusion as much as possible within the groundwater basin."* (emphasis added) (See Cited Document 62, p. 9.)

Like the CDP, the RWMP is supposed to address and mitigate all adverse groundwater-related impacts. However, the RWMP stays very general. The "Recycled Water Program" refines recycled water use amounts, based on "program participation agreements" (letters of interest) with farmers and large urban users (e.g., schools). It also provides general background information on water quality parameters and regulations. However, it forth the same set of reuse/disposal options identified in the CDP without addressing the problems identified in this Request (e.g., no feasible back up for Broderson or measures to replace flows to habitat.)

The Conservation Program presents a draft conservation plan prepared for the ISJ Working Group by Maddaus Water Management that the County intends to use (with minor changes) to satisfy Condition 5b. The conservation plan shows a potential reduction of water use of about 700 AFY by 2035 (achieving the 50 gallon per capita per day project objective by 2015), but the estimate is based on 2006 to 2008 water use figures, so almost all of the 700 AFY reduction the plan identifies has already been achieved.

The RWMP Monitoring Program includes a groundwater monitoring program (that "relies heavily" on the ISJ "Basin Plan") and an "Environmental Monitoring Plan" (EMP) the County will implement. The

program requires the County to set "success criteria" for the EMP, but it states the ISJ Basin Plan will set the criteria and objectives for groundwater mitigation (e.g., seawater intrusion mitigation). Thus, the program does not ensure groundwater impacts will be mitigated (e.g., measurable and enforceable).

Finally, the RWMP indicates the "Reporting and Adaptive Management Program" will ensure other programs meet the overall objectives of the RWMP by recommending and implementing modifications and corrective actions when needed. However, it does not identify specific, feasible options for habitat mitigation, and it turns over responsibility for seawater intrusion mitigation to purveyors and other stakeholders.

Although the RWMP adds some specificity to groundwater mitigation measures, it applies the same group of mitigation measures identified in the CDP, which fail to mitigate for the project, and it fails to identify specific and feasible adaptive measures or performance objectives to respond to future impacts. It further does not resolve a major problem in Condition 5, the selection of measures inconsistent with Condition 5 objective (i.e., to reduce seawater intrusion as much as possible as soon as possible). The following provides some of the specific issues, with a more complete discussion in Sections I.E.2.d.ii through I.E.2.d.v.)

1. <u>The RWMP fails to identify feasible mitigation measures consistent with the CDP.</u> Broderson disposal and agricultural reuse do not prioritize seawater intrusion mitigation. Inconsistencies and qualifying phrases in the CDP are the source of this problem. Basically, Condition 5 and the RWMP do require the County to implement any specific mitigation measures or ensure any specific benefits or outcomes from the programs. County officials can apply recycled water and implement conservation measures however they deem appropriate. The program, for instance, does not require a specific amount of pumping to be reduced from wells causing seawater intrusion.

2. <u>The RWMP fails to address the infeasibility issues of proposed measures and other reasons measures will not mitigate for severe potential impacts.</u> An assessment/analysis of additional/more serious impacts due to accelerating seawater intrusion, and the potential impacts of a recycled water program were needed to determine whether impacts could be mitigated and the least harmful options/alternatives. (<u>Note:</u> The failure of the Commission to require essential assessments/analyses prior to project approval, in order to determine measure are measurable, enforceable, and feasible resulted from the County and CCRWQCB providing inaccurate and incomplete information. Accurate and complete information would have reasonably would led to findings that mitigation is not possible for the project and a less harmful feasible alternative is necessary.)

3. The RWMP allows the County to avoid a commitment to mitigation for the project by assigning mitigation tasks and responsibilities to purveyors and other stakeholders (e.g., setting success criteria and performance objectives for seawater intrusion mitigation.)

(See Section I.E.2.j. Table B for a list of the Condition 5 mitigation programs reasons they are infeasible and/or fail to mitigate, and the accurate information/assessments/analyses that would have revealed their infeasibility.)

***I.E.2.d.*ii The "Recycled Water Reuse Program" of the RWMP does not mitigate for the project's impacts on seawater intrusion or habitat.** Because the RWMP presents reuse options inconsistent with stated objectives, the effect on measures is the same as with Condition 5: The measures achieve no particular benefit, and the County is held to no particular performance objective. The program is basically a means of disposing treated effluent to the extent possible. This is highlighted by the fact that only 5% of the recycled water in the proposed plan goes to measures that maximize seawater intrusion, i.e., reuse at schools (42 AFY). The RWMP indicates the County may provide water to farmers even though the reuse would offset no pumping and would create new water uses within the basin.

The Recycled Water Reuse Program fails to mitigate because it is inconsistent with stated objectives (e.g., "…offsetting seawater intrusion as much as possible…

The RWMP states that its primary objective is

> *… to mitigate sea water intrusion by offsetting current pumping and production from the groundwater basin. Therefore, the County's highest priority for delivery is to provide recycled water that will offset current production within the urban area over the groundwater basin."* (See Cited Document 70, p. 4)

The RWMP adds: "Reuse must be prioritized to benefit the community water resources and mitigate sea water intrusion." (See Cited Document 70, p. 24.)

Despite the emphasis on seawater intrusion mitigation, the program—like the CDP--does not prioritize seawater intrusion mitigation. This is clear from the reuse measures selected and the seawater intrusion mitigation factors for each: Broderson disposal, 448 AFY (0.22 mitigation factor), agricultural reuse, 160 AFY (0.1 mitigation factor), urban reuse at the cemetery, 50 AFY (0.1 mitigation factor), urban reuse at schools, 42 AFY (0.55 mitigation factor), urban reuse at Sea Pines Golf Course, 30 to 45 AFY (0 mitigation factor because it offsets pumping from the upper aquifer, not the lower), and Bayridge Estates disposal, 33 AFY (0 mitigation factor because it is supposed to recharge the perched aquifer, Zone A.) (See mitigation factors, Cited Document 65, p. 5 and Cited Document 38, p. 22.)

As discussed in I.E.2.c.iii, Broderson disposal does not mitigate for impacts on seawater intrusion in the lower aquifer (i.e., the 0.22 factor is speculative given the level of uncertainty, timescales, etc.) and the leach fields could be shut down failing to provide any benefits at all. (Also see I.E.2.f.) Therefore, the only measure proposed in the RWMP recycled water program that will potentially offset pumping of the lower aquifer and directly benefit seawater intrusion is reuse at the schools, 42 AFY out of the approximately 750 AFY of recycled water from the project or 5%.

[Note: The "mitigation factors" for measures that do not offset pumping of the lower aquifer--Broderson leach fields, agricultural reuse, and cemetery reuse--are based on modeling, so their potential benefits are indirect and they have higher levels of uncertainty than measures that reduce pumping of the lower aquifer. Ag reuse is estimated to provide a 0.1 or 10% benefit (i.e., for every 10 gallons of water used, 1 gallon reduces seawater intrusion). As with Broderson leach fields, ag reuse is not certain to provide any benefit due to timescales and other uncertainties. Even the measures that offset pumping can only reduce seawater intrusion if purveyors are willing and able to cut back pumping in seawater-impacted wells. (See further discussion in "Conservation" below.)]

Ag exchange (the exchange of recycled water for agricultural well water returned to the urban area) would be necessary to offset pumping of the lower aquifer and provide a direct benefit to seawater intrusion; however, such program is infeasible because Los Osos area farmers will not be motivated to participate in the program for a variety of reasons discussed below.

The RWMP "Recycled Water Reuse Program" fails to mitigate because it does not address potential adverse impacts and feasibility issues resulting from high salt content in the treated effluent. The high salt content of the treated effluent due to seawater intrusion could cause Broderson disposal to fail and farmers and urban water users to opt out of the program. This is because high salt content can cause destroy groundwater and habitat. The RWMP discusses water quality parameters and restrictions in general, but avoids the issue of high salt content in Los Osos recycled water. It states, "Actual effluent quality for the Los Osos Wastewater Treatment Plant is not available since the plant is not operational at this time." (See Cited Document 70, p. 22.) It later states, "The County of San Luis Obispo will evaluate the recycled water usage annually to determine its efficiency and effectiveness in meeting the goals of the recycled water program." (See Cited Document 70, p. 30.) However, the salt content can and should be estimated, with feasibility issues and alternatives discussed. Instead, the plan avoids the issue altogether.

Roger Briggs, Executive Officer of the CCRWQCB, points out that a recycled water program can destroy soils and aquifers due to salt build up. In his DEIR comments Mr. Briggs states:

> *Salt management is important in addressing the potential impacts for salt accumulation in groundwater aquifers. -The only discussion of salt management in Section 2.4 (Project Components) and Section 5.2 (Groundwater Resources - Cumulative Impacts) of the DEIR, is*

regarding saltwater intrusion. The DEIR does not discuss potential salt accumulation due to the continuous disposal of wastewater in a designated location, specifically, spray field irrigation at the Tonini property and at the leach field at the Broderson site. Salt buildup in upper groundwater aquifers is a common problem in the Central Coast Region due to a mixture of agricultural irrigation practices and land disposal of treated wastewater. Excessive salt build up in groundwater aquifers has the potential to render the aquifer useless for future agricultural or domestic supply water use…

Section VIII.C.4 of the Central Coast Water Quality Control Plan (Basin Plan) discusses the need for salt management and improved salt management techniques. Some suggestions provided in Section VIII.C.4 of the Basin Plan include using wet weather storage reservoirs to dilute groundwater, improving the quality/quantity of the groundwater aquifer. Also, this section discusses the use of drainage wells which divert rainwater to salt sinks in order to increase dilution. (See Cited Document 63, pp. 3 & 4*)*

Thus, the Executive Director of the CCRWQCB identified potential adverse impacts from a recycled water program, but the adverse impacts remain unmitigated. In the FEIR the County responded to this comment by claiming the impacts are insignificant because septic system discharge has similar salt levels to Broderson discharge. (See Cited Document 29, p. 3-48. Note that salt levels are reported as total dissolved solids or TDS). However, the FEIR responded to Mr. Briggs before the County Planning Commission added urban and agricultural reuse to the project, also reserving "at least 10%" of recycled water for habitat. Thus, the FEIR does not address how the project mitigates for adverse impacts on farmland and sensitive habitat, including Los Osos Creek, nor does it specifically address Mr. Brigg's concern regarding how a large amount of recycled water discharged in one location (Broderson leach fields) will be mitigated to protect the water supply and soils.

Salt levels in recycled water will be much higher than when Mr. Briggs submitted his DEIR comments, substantially increasing potential adverse impacts on aquifers and soils.. Mr. Briggs submitted his DEIR comments before release of the *Los Osos Groundwater Basin Update* (See Cited Document 47) in May of 2010. The Basin Update showed that seawater intrusion had accelerated, causing a substantial increase in the salt levels of the domestic water supply. This increase will raise the salt content of recycled water. The CCWQCB WDR Staff Report states that the average TDS level in the Los Osos water supply based on the Basin Update (tests in January of 2010) is 580 mg/l. (See Cited Document 23, Item 13, p. 22.) The DEIR estimates the average TDS levels in the water supply in 2006 at 420 mg/l (an average of the low and high tests for that year--320 mg/l and 520 mg/l). The DEIR estimates are based on the LOWWP *Fine Screening Report* (Carollo Engineers, August 2007, Cited Document 81), which adds 200 to 300 mg/l of TSD to the TDS of the domestic supply to estimate the TDS of the wastewater stream. The Report uses the lower number (200 mg/l) to arrive at an estimate of 620 mg/l of TDS cited in the DEIR (420 mg/l + 200 mg/l). (See Cited Document 81, pp. 2-21 & 2-22 and Cited Document 38,

pp. 15 &16.) Adding 200 to 300 mg/l to the average TDS of 580 mg/l raises the TDS (as of January 2010) to 780 mg/l to 880 mg/l.

The *LOWWP TM: Effluent Reuse and Disposal Alternative* (Carollo Engineers, April 2008) states that crop yield for lettuce and peppers is adversely affected by TDS levels over 770 mg/l and 825 mg/l respectively, and the County *Draft Recycled Water Management Plan* (RWMP) shows irrigation uses are restricted when TDS is between 450 mg/l and 2000 mg/l TDS. (See Cited Document 81, 2-21 & 2-22 and Cited Document 70, p. 22.) The Draft RWMP also shows that "chloride" levels over 140 mg/l restrict irrigation uses. (Chloride is one of the elements in sodium chloride, NaCl, commonly used as an indicator of seawater intrusion, e.g., by the CCRWQCB.) The Basin Update shows average chloride levels of the water supply before domestic use (as of January 2010) to be 177 mg/l. Assuming chloride levels increase with domestic use on a par with TDS, chloride levels in treated effluent will be well over 200 mg/l with the project. (See Cited Document 47, Exhibit B, Table 1.)

Since release of the Basin Plan in May 2010, seawater intrusion has continued to advance, raising salt levels in the domestic supply. Chloride levels at the main LOCSD supply well (the Palisades Well) rose from 360 mg/l in January of 2010 to 398 mg/l in May 2011. (See Cited Document 77, p. 5 of 9.) The County Draft RWMP shows that chloride levels of 350 mg/l or more result in "severe" irrigation use restrictions. (See Cited Document 70, p. 22.) The Palisades well supplies about half water the LOCSD produces and as much as one-fourth of the total urban supply; therefore, high chlorides at the Palisades well will have a significant adverse effect on the overall quality of the project's recycled water.

Based on an April 2005 nitrate monitoring study, the LOWWP WDR reports that shallow wells have average TDS levels of 333 mg/l, and the DEIR estimates TDS levels in the Los Osos Creek valley, where agricultural reuse will occur, to be 520 mg/l. (See Cited Document 11, p.2 and Cited Document 38, p. 16.) Freshwater habitat, such as Los Osos Creek, has much lower salt content than either of these groundwater sources. Thus, the recycled water program, including Broderson and Bayridge leach field disposal, will significantly degrade the water supply, potentially destroying aquifers and soils, as well as vital habitat.

<u>Contaminant levels, regulation and infrastructure requirements for recycled water make farmer and urban property owner participation in the program unlikely indicating that the LOWWP recycled water program is likely to be non-viable.</u> The high salt content of the recycled water from the project will make the water undesirable to farmers and large urban water users. Not only will it be unsuitable for some crops, but as Mr. Briggs points out, it will result in salt build up in the soil and aquifers potentially destroying these resources. At a minimum, LOWWP recycled water will require those who use it to flush soils periodically with potable well water. This offsets the benefits of the program for the basin and the cost-effectiveness those who participate in the program. A SWRCB information sheet available

on its website explains how and why salt (NaCl) adversely impacts soils and groundwater, and the need for flushing soils. (See Cited Document 82, e.g., pp. 2-4 of pdf.)

The CCRWQCB and the California Department of Public Health (CDPH) consider recycled water a source of pollution, and they require users to adhere to strict regulations, including monitoring requirements and prohibitions against overwatering and allowing run off to enter surface waters. Regulations also require use of special piping and labeling (purple pipe, backflow controllers, and warning signs) for users. If regulations are violated, the users of recycled water face CCRWQCB enforcement actions and fines.

As evidenced by the comments of Barry Brannin, a Los Osos farmer, the commitment of farmers to the program--and program viability--are far from certain. As farmers learn more about the requirements of the program and water quality, they are likely to opt out. In comments before the Board of Supervisors on October 11, 2010, Mr. Brannin states:

> *I own 400 acres immediately north* (of the treatment site). *We* were probably of all the ag people the most likely user … *Mr. Edwards (previous speaker) mentioned the fact that the new runoff rules that are coming to all farmers says you're responsible for anything that runs off your property, so here, the County, in this process is asking us, the farmers, to accept water that is not equal to what our well water is, so we're receiving in essence a pollutant. The total dissolved solids that are in the water are not pinned down. They should not be greater than what the dissolved solids are from our well water because if we did it, we'd be polluting our property and therefore responsible for any runoff that would go into the bay. So this whole water quality issue is not defined enough that I could sign an agreement with the County. As I said we have 400 acres. We're farming heavily. There are two other immediate farmers in the area that are farming agriculture heavily. We use lots of water but I can not see that this agreement, this proposal made any common sense* (Emphasis added) (See Cited Document 83.)

The RWMP states that six agricultural growers signed "program participation agreements," and the County is now developing "delivery agreements with the growers." (See Cited Document 70, p. 29.) As Mr. Brannin's comments show, farmers who signed "participation agreements," will want to know much more about the program and will most likely want guarantees that recycled water quality (salt level) is better than their well water. As they learn more, they are very likely to find the program not cost effective, or unacceptable due to the salt content of the water or regulations.

In the Salinas-Monterey area farmers have much more incentive to overlook the downsides of a recycled water program. In the Salinas-Monterey area, where a recycling program has been in operation for some time, seawater intrusion makes agricultural well water unusable. As a result, farmers are very motivated to accept the expense and regulatory requirements of recycled water use.

In the Los Osos area, the opposite is true: Seawater degrades the urban supply, which makes the recycled water even less desirable for farmers.

The recycled water from the project could have an adverse impact on sensitive aquatic habitat, including protected steelhead habitat, due to high salt content. In a response to National Marine Fisheries Service (NMFS) regarding the project's potential adverse impacts on Los Osos Creek and Los Osos Creek Estuary (habitat for federally-listed endangered steelhead), the FEIR claims the project will not result in discharges of treated effluent in the vicinity of the creek. (See Cited Document 29, pp. 3-23 & 3-24). However, the response was issued prior to the addition of the recycling program to the project, which could supply water for ag/urban reuse near the creek. Furthermore, as discussed in Section IE.2.b., reduced groundwater flows to Los Osos Creek have not been mitigated, and recycled water could be used for this purpose.

The adverse impacts of recycled water on sensitive habitat not only include adverse effects from high salt levels, but from a range of other contaminants, including emerging contaminants not removed by the project's treatment process. Angel Law cited these impacts in an appeal of the WDR submitted to the CCRWQCB on behalf of Citizens for a Sustainable Community, a Los Osos Citizen's Group, on March 3, 2011. (See Cited Document 49, e.g., pp. 6-8 and appeal attachments.) Since recycled water could be used in farming areas near Los Osos Creek, to restore flows to Los Osos Creek, and/or for landscaping near the creek; the NMFS should have been notified of the potential impacts on steelhead habitat.

(See I.E.2.b. and I.E.2.d.iv. for further discussion of the recycling program's potential adverse impacts, e.g., on ESHA

A salt and nutrient management plan required by the CCRWQCB as a condition of the Waste Discharge Permit (WDR) does not mitigate for the project or ensure program feasibility. The CCRWQCB required a salt and nutrient management program as a condition of WDR permit approval. (See Cited Document 11, p. 7.) However, the program is supposed to be developed, implemented, and funded as part of a basin-wide stakeholder process, so the specific outcomes, measures, and timeframes of the program are uncertain and do not ensure mitigation for the project (i.e., do not provide specific, measureable, and enforceable mitigation—nor ensure options are feasible). A viable program, at a minimum, is likely to require further treatment of the wastewater to reduce salts and such requirement will be economically, and possibly technically, infeasible. To mitigate for adverse impacts and ensure recycled water program feasibility, program impacts and feasibility would have had to be determined prior to project approval.

A recycling program "feasibility study," required by the SWRCB for grant funding does not establish program feasibility or ensure the program mitigates for seawater intrusion—and it shows program feasibility was not established at the time of project approval. As a requirement for grant funding for the Recycled Water Program, the SWRCB is requiring a "feasibility" study. (See Cited Document 88,

e.g., p. 3 and the Cited Document 89, e.g., p. 3.) Prior to funding the program, the SWRCB will also require an environmental review for the recycling "project."

These requirements provide substantial evidence to support the following: 1) the LOWWP recycling program may not be feasible (possibly due to high salt content in the water), 2) the CCRWQCB and County know (and knew at the time of project approval) a recycling program constitutes a separate project that must be evaluated for feasibility and potential adverse impacts, and 3) the Coastal Commission did not establish the feasibility of a recycling program prior to project approval nor provide for adequate review. (We assume this was due to the failure of the County and CCRWQCB to provide accurate and complete information.)

<u>The SWRCB grant funding requirements show a subsequent EIR (SEIR) for the LOWWP was needed and required to address potential adverse impacts, including cumulative and socio-economic impacts from from the recycled water program. It also highlights the inadequacy of the CDP and Condition 5 to mitigate for impacts on coastal resources.</u>

A "feasibility study" for the program after-the-fact (project approval) does not establish program feasibility. It will simply rubber stamp a pre-approved project and program, and it does meet CEQA standards for mitigation. "Environmental review" after approval obviously does not meet CEQA standards. An indication that the feasibility study will not be valid is that study's scope of work waives review of the "no project" alternative, in addition to any analysis of alternative "pollution control" methods (e.g., nitrate management). (See Cited Document 89, pp. 8 & 18.) The fact that the County is required to only to provide "letters of interest" from farmers and urban users to prove feasibility, rather than signed commitments for recycled water, provides further evidence the study is not a true study. (See Cited Document 88, p. 6.)

<u>County officials, including the Public Works Director, Paavo Ogren, knew the approved project did/does not have adequate disposal capacity at the time of the June 2010 Commission hearing.</u> Paavo Ogren, the County Public Works Director (aided by Maria Kelley, a LOCSD director at the time) attempted unsuccessfully to have harvest wells installed in the urban area of Los Osos in August of 2009. (See Cited Document 72). Similar to the previous Los Osos project, this would have allowed more effluent disposal at the Broderson site and/or the possibility of installing leach fields in the area. As mentioned, harvest wells are prohibited and considered infeasible for this project. (See Cited Document 60, Condition 1j. and I.E.2.b.i.)

The RWMP, the SWRCB requirement for a feasibility study, and the EIR confirm that the recycled water program does not mitigate for project impacts, instead adding cumulative impacts that should have been addressed prior to project approval. Evidence further confirms the County and CCRWQCB knew the adverse impacts were not mitigated, but withheld this crucial information.

I.E.2.d.*iii *The RWMP "Conservation" program does not mitigate for project impacts on seawater intrusion and habitat.

Overview: Several experts have recognized that conversation is the quickest, most direct and cost-effective way to reduce seawater intrusion in the Los Osos basin, and they have recommended maximizing conservation to mitigate for the project and stop seawater intrusion (e.g., Yates, Mayer, Smith, and CSUMB Watershed Institute). (See Cited Document 35, e.g., p. 1, Cited Document 76, Cited Document 67, p. 67, and Cited Document 75, e.g., p. 2.)

However, when experts reviewed the project, they were under the impression that conservation would provide much more mitigation than it can. Based on recent water use figures for the LOCSD, water use within the urban area has dropped about 800 AFY since 2004. This shows that the County officials, as well as ISJ and LOWWP documents, have significantly overstated the potential of conservation to mitigate for the project. This major reduction in use of well over 30% occurred at the same time seawater intrusion accelerated by 12 times. These facts support three conclusions: 1) Conservation is currently not having a verifiable beneficial effect on seawater intrusion (and does not ensure a reduction in seawater intrusion), 2) the potential for conservation to mitigate for seawater intrusion, including project impacts on seawater intrusion, has been substantially reduced (by 75% or more), and 3) seawater intrusion may destroy enough of the basin to render it unsustainable as the sole water source for the existing population. The last possibility would necessitate a supplemental water project that could be infeasible, and, at a minimum, would result in major cumulative and socio-economic environmental impacts. The result could be severe water shortages for the area and/or severe social and economic consequences leading to catastrophic consequences.

Conservation will not mitigate for project impacts on seawater intrusion; its potential benefits have been erased by a large amount of conservation since 2005 that officials failed to report. Seawater intrusion has accelerated by 12 times since 2005, despite a substantial reduction in pumping in the urban area where seawater intrusion is occurring. A recent accounting of LOCSD water delivery shows that the utility, serving about half the properties in the urban area of Los Osos, pumped about 700 AFY of water in fiscal year 2010-2011—and it shows demand since July of 2011 is even lower. (See LOCSD Water Use.) This means that water use among LOCSD customers (about half the customers in the urban area) went down more that 350 AFY since 2004. (See ISJ TM Urban Yield, "Los Osos Water Purveyor Water Production" chart, p. 15 of pdf.) According to informal reports, the other main water supplier in Los Osos, Golden State Water Company (GSWC), serving about half of Los Osos customers, has similar reductions. The third water company, S&T Mutual, serves about 500 properties of about 5000 in the urban area. Therefore, a reasonable estimate of current purveyor water production in the urban area is 1400-1500 AFY. This represents 700-800 AFY reduction since 2004, the baseline year for DEIR studies, and a 550-650 AFY reduction since 2004-2008, the baseline years for the ISJ draft conservation plan (*Water Demand Analysis and Water Conservation Evaluation*, Maddaus Water Management, April 2011).

The Draft RWMP reports that the County plans to use the ISJ draft conservation plan as a basis for the project conservation program. However, all but 100 AFY or so of the plan's projected water savings by 2035 has apparently already been achieved (See Cited Document 90, e.g., p. 19.)

This very large reduction is likely due to a combination of the progressive rate structures purveyors implemented in recent years, a poor economy, and increased use of water-efficient fixtures and technologies. The fact that so much conservation has occurred since 2004--at the same time seawater intrusion accelerated--demonstrates that conservation will not mitigate for the project's impacts on seawater intrusion. It also demonstrates that stopping seawater intrusion will be extremely difficult, even without mitigating for the project's adverse impacts on the basin. The project will only make a basin under stress and in danger of failure more likely to fail. (Also see Section I.E.2.b.)

Aggressive conservation has some potentially adverse impacts that have not been evaluated or mitigated. Aggressive conservation can cause more frequent and serious overflows of a conventional gravity collection system because it reduces the volume and rate of flows, causing more frequent blockages. More frequent overflows significantly increase the potential for pollution of surface waters as evidenced by overflows in the county. (See Section I.E.1.b.v.) To attempt to reduce overflows requires much more frequent flushing and substantial water use, causing adverse impacts to the water balance and seawater intrusion. Adverse impacts on water balance occur even if recycled water is used for flushing because recycled water is supposed to offset potable water use. The County and CCRWQCB claim that good maintenance of the collection system via a Sanitary Sewer Management Plan (SSMP), required as a condition of the WDR, will minimize these potential impacts. However, two of the foremost authorities in the country on wastewater and water management, Dr. George Tchobanoglous and Dr. Ronald Crites, state in a popular textbook entitled *Small and Decentralized Wastewater Systems Management,* that the amount of water required to flush a conventional gravity system with intensive conservation offsets the benefit of conservation. Keith Wimer included a passage from the textbook in his DEIR comments, so the County and CCRWQCB are aware of this impact. (See Cited Document 28, p. 3-677.)

Eugene Yates also points out that conservation raises the salt levels in treated effluent (e.g., TDS and chloride levels in recycled water). Recycled water from the LOWWP is already likely to be very high salts due to seawater intrusion and its effects on the domestic supply (which becomes recycled water). While Mr. Yates emphasizes that aggressive conservation is essential for basin sustainability, he recommends re-evaluating mitigation options to account for all factors and determine the most effective options. He further recommends integrated, basin-wide management, using the most effective measures, including conservation, LID recharge, and shifts in pumping with nitrate treatment at the well (See Cited Document 35, pp. 1, 4, 5, & 7.)

To mitigate for seawater intrusion with conservation requires purveyors to have cooperative agreements in place and be willing and able to make timely and strategic changes in pumping regimes.

The ability and willingness of purveyors to shift and adjust pumping is critical to mitigating for seawater intrusion with conservation. This requires purveyors to have cooperative nitrate treatment, intertie, and blending agreements to optimize flexibility and overall basin management. A purveyor "Basin Plan" was supposed to be completed by December of 2009, formalizing the cooperative agreements, but it is still not out, and purveyors have failed to agree even on an intertie facility that was supposed to be completed by December of 2008. (See Cited Document 48, pp. 8 & 9.) A recent CCRWQCB ISJ Update provides no projected date for completion of a draft plan and it indicates a cooperative treatment, blending, and intertie agreement has been put on hold indefinitely (See Cited Document 45, e.g., pp. 3 & 4.) The lack of cooperative agreements will reduce the effective of conservation as a mitigation measure.

The counsel for Golden State Water Company (GSWC) confirms that purveyors are reluctant to implement conservation measures, and also confirms that conservation requires purveyor cooperation to reduce seawater intrusion. In a letter to the County Planning Commission in a 2009 letter, he said the company couldn't ensure it would reduce pumping at locations impacted by seawater intrusion and indicated that 160 AFY of conservation (proposed for the project at the time) was not likely doable. (See Cited Document 73, pp. 2 & 3.) This highlights the fact that conservation does not ensure project mitigation for seawater intrusion.

<u>With or without the LOWWP, conservation (i.e., water use efficiency) must be optimized to maximize the potential for a sustainable basin</u>. Eugene Yates points out that shifting pumping to the upper aquifer and inland does not increase basin capacity. He says conservation is needed to provide a long-term fix for seawater intrusion—i.e., to correct the root cause of seawater intrusion, more water pumped from the basin than recharges it causing a water imbalance. (See Cited Document 35, p. 1.) In June of 2010, Mr. Yates recommended immediate shifts in pumping with aggressive conservation. At that time, urban water use was reported to be about 2043 AFY, when in actuality it was closer to 1600 AFY, and Mr. Yates' recommended reduction of 500 AFY had already been achieved for the most part. To address what Mr. Yates called and "extremely urgent" problem in June of 2010, most pumping must be shifted to the upper aquifer as soon as possible. (See Cited Document 35, pp. 1 & 6.) Mr. Yates and the CSU Monterey Bay Watershed Institute also recommend maximizing conservation with a range of water use efficient strategies to extend the current water supply, including indoor and outdoor measures, greywater reuse, rainwater harvesting, and LID recharge. (See Cited Document 35, pp. 2-3 and Cited Document 67, e.g., p. 67.) These measures must be pursued to maximize the chances of basin sustainability without the project. The project will only make a strong water use efficiency program unaffordable for residents.

<u>The ISJ-County draft conservation plan confirms the County is not committed project mitigation or complying with the CDP, (e.g., "…offsetting seawater intrusion as much as possible…as soon as possible</u>." (See Cited Document 62, p. 9.) Peter Mayer, a nationally-recognized expert on conservation, states that a target of 42 gallon per capita per day (gpcd) for indoor use is achievable for Los Osos and

should be set to reduce seawater intrusion as much as possible. He further states that the County-proposed ISJ draft conservation plan with a target of 50 gpcd does not do all it could to address the urgent seawater intrusion problem. (See Cited Document 75, e.g., pp. 2 & 3.) Mr. Mayer emphasizes the use of rate structures as incentives to reduce water use and suggests implementing individual water budgets. The very large reduction in water use in the community since 2005, especially in the past three years, undoubtedly results, in large part, from rate structures implemented within the last few years by the two largest purveyors (the LOCSD and Golden State Water Company). A 42 gpcd target, along with greywater reuse and rainwater harvesting, offer ways to further reduce and maximize conservation (water use efficiency) to stop seawater intrusion. The conservation potential remaining must be applied to seawater intrusion directly via a comprehensive management program, not as mitigation for the LOWWP.

The County collects water use data annually and reviews the data as part of the ISJ process. Therefore County officials were aware of dramatic drop in Los Osos water use as of June of 2010. County Supervisor Bruce Gibson and other County officials (e.g., John Waddell, Project Engineer) publically stated that the County did not intend to spend all the $5 million on conservation although the CDP states that the program "…shall be designed to achieve its identified goals, including the 50 gallons per day target, and shall include provisions for use of the $5 million…to initiate water conservation measures pursuant to the Basin Plan as soon as possible following CDP approval." (See Cited Document 62, pp. 9 & 10, and Cited Document 60, Condition 99.) The County has been an ISJ Working Group member since 2008 and participated in the decision to use 2004-2008 water use data as a baseline for the draft conservation plan despite the data substantially overstating water use (about 500-600 AFY) and the mitigation potential of conservation for the project. This evidence supports a conclusion that County officials have intentionally withheld information crucial to Commission decision making and informed public input since prior to June of 2010.

I.E.2.d.iv. The RWMP "Monitoring Program" does not ensure impacts are mitigated or measures are feasible.

Monitoring is not mitigation, and for it to support an effective mitigation program, the program (e.g., adaptive management program) must have specific, measurable, enforceable--and feasible -- mitigation measures and performance objectives. An effective program also requires critical assessments and reviews to be done before project approval to ensure mitigation is feasible and to identify the least harmful feasible options. The LOWWP monitoring program will not help mitigate for project impacts because these basic criteria for successful mitigation have not been met.

<u>The project is not mitigated because essential assessments and analyses were not done prior to project approval</u>. A baseline assessment of groundwater flows to Willow Creek from septic systems and an analysis of mitigation options were needed to ensure impacts to ESHA could be

mitigated. Also, the project's impacts on accelerating seawater intrusion should have been evaluated to determine whether impacts could be mitigated and the specific feasible measures. Assessments/analyses that provide accurate and complete information would have shown that conservation and other measures could not successfully mitigate for impacts on seawater intrusion and habitat. Completed after-the-fact, assessments and analyses (e.g., the feasibility study the SWRCB is requiring for the recycled water grant) only rubberstamp foregone conclusions. They do not ensure the feasibility of measures or the mitigation of project impacts.

The project is not mitigated because success criteria will not be specific, measureable and enforceable.

The Final CDP states

> *The Monitoring Program shall be designed to quantitatively and qualitatively assess the effectiveness of the Basin Plan over time to ensure its objectives are achieved, and shall include: a baseline physical and ecological assessment of ground and surface water and related resources to be monitored; measurable goals and interim and long-term success criteria for those resources, including at a minimum clear criteria that demonstrate that the health and sustainability of Plan area resources are steadily improving over time, including with respect to seawater intrusion…*(Emphasis added) (See Cited Document 62, p. 10.)

To "…qualitatively and qualitatively assess the effectiveness of the basin plan…" (Condition 5) and to develop "…measurable goals and interim and long-term success criteria…to ensure its objectives are achieved…" requires Condition 5 to have clear and consistent objectives. Instead, its objectives are vague and inconsistent, highlighted by the fact that the condition identifies Broderson leach fields as the main mitigation option although the measure does not to offset seawater intrusion "as much as possible…"per the Final CDP. (See Cited Document 62, p. 9.)

The project is not mitigated because success criteria and performance objectives for seawater intrusion mitigation will be developed by purveyors as part of the ISJ basin planning process. This removes the County's responsibility for mitigating seawater intrusion. The RWMP indicates that the parties to the ISJ and the "Basin Plan" under development will provide monitoring and set objectives for seawater intrusion mitigation.

> *The program managed pursuant to the future Basin Plan, however, is intended to be the primary groundwater monitoring program for the Basin, and other groundwater monitoring efforts undertaken by the County and other Parties will meet any additional requirements as well as be made consistent with the Basin Plan to the extent possible…*
>
> *The RWMP Monitoring Program will likely rely heavily on the future Basin Plan as a source of data for annual reports, as well as baseline assessment, establishing success criteria, and ensuring its objectives are achieved. The RWMP Monitoring Program will also need to be*

supplemented with other types of resource monitoring, as described in Section 4.7 "Environmental Monitoring Program." As the ownership and operations entity for the LOWWP, the County will be responsible for collection, compilation and reporting of any data to meet the Coastal Commission requirements. (See Cited Document 70, p. 57 & 58.)

4.8 Program Implementation
Implementation of the County's Groundwater Monitoring Program will be coordinated by the County with the Water Purveyors and private well owners. Basic tasks are outlined as follows:
…

- *Assign water quality and level monitoring responsibilities to each stakeholders (sic). …*

- *Contact private well owners to request permission for participation in the groundwater elevation and water quality portions of the groundwater monitoring program (including future CASGEM program and salt and nutrient management plan monitoring program). A final list of monitoring locations will be prepared following this task. …*(See Cited Document 70, p. 79.)

The above provisions remove the County's responsibility for seawater intrusion mitigation. For any mitigation program to be effective, the agency administering the project must commit to mitigation, i.e., setting and achieving measurable and enforceable "success criteria" and performance objectives. (See Section I.E.2.j. for further discussion on County's failure to commit to mitigation.)

The RWMP states that the County is able to implement an ordinance, which would allow the County to have more control over seawater intrusion objectives; however, the RWMP indicates that the County plans to use the purveyor "Basin Plan" to meet the requirements of AB 3030 and SB 1938. These bills require development of a basin management plan, with specific objectives for ensuring a sustainable water supply. (See Cited Document 70, p. 58.) The "Basin Plan" will undoubtedly provide the basis for an ordinance. Thus, the County is turning over its responsibility to develop a specific and measurable objectives to mitigate for seawater intrusion and establish a sustainable basin to purveyors. Purveyors will not set objectives that require them to achieve specific outcomes with regard to seawater intrusion, so the ordinance will not ensure project mitigation or basin sustainability. Further, the County has jurisdiction over the entire basin as administrator of the Conservation and Flood Control District. Purveyors are responsible only for one-half (1/2) to two-thirds (2/3) of the water pumped in the basin, so the County is limiting its authority to management the basin. Effective management of seawater requires basin-wide ordinance with specific and enforceable objectives. (See Cited Document 102, p. 9.) (See Section I.E.3. g. for further discussion of the ISJ.)

The ISJ agreement allows the County to implement an ordinance even if purveyors do not agree, and LCP Policy 5 calls for the County to implement a comprehensive basin management program in cooperation with the CCRWQCB (See Cited Document 48, p. 8, and Cited Document 80.) Therefore, an ordinance with specific, measurable, and enforceable objectives for stopping seawater intrusion and mitigating for the project could be implemented. (Note: An ordinance could also be implemented without the project, providing a better chance of basin sustainability, by avoiding severe adverse impacts and uncertainties from the project.)

(See further discussion of an ordinance and the County's failure to commit to mitigation in Section I.E.2.j.)

The RWMP "Environmental Monitoring Program (EMP)" shows that the County does not intend to mitigate impacts on habitat from reduced flows.

The RWMP is vague and contradictory when discussing potential impacts to habitat, repeatedly stressing that changes in habitat could be caused by factors other than the project. This language indicates that the County does not intend to mitigate for adverse project impacts on habitat.

> *Total success would consist of no discernable (sic) changes in wetland size or vegetative composition over the life of the project; however, gradual changes in vegetative composition are expected to result from establishment of long-term "new normal" site conditions that include drier or wetter soils, or an increase or decrease in groundwater salinity. Since wetland habitats are dynamic natural systems, any such long-term changes identified during annual monitoring efforts could be the direct result of project activities, or could be wholly or partially caused by other factors, such as normal fluctuations in yearly average temperatures and rainfall amounts received, introduction of a new invasive plant species, or new water well installation. An observed change from wetland to upland habitat would constitute a significant negative result, while the reverse situation of increasing wetland area might also have negative effects on surrounding habitats. Changes in wetland habitat types (i.e., from freshwater to saltwater marsh), may not necessarily be a negative result, and would depend on analysis of the specific conditions.*
>
> *The EMP includes overall Interim and long-term success criteria for the monitoring areas… When a significant deviance from baseline conditions is noted at a site or as a combined total of site conditions, previous weather patterns or other outside influences must be examined, and a determination made regarding whether non-project related factors are contributing to the monitoring results…*

Interim Success Criteria

The Interim period constitutes the approximate two-year decommissioning and recycled water implementation period, and is expected to be too short to document gradual changes in resource conditions. Any vegetative changes occurring in monitored areas during or immediately following septic decommissioning will be the result of a rapid and significant change in groundwater levels resulting in drier or wetter soil conditions, or a rapid increase or decrease in groundwater salinity. The result could be a loss of wetland habitat area or changes in vegetative composition of wetland habitats. These changes would be likely related to the decommissioning process, but could also be influenced by abnormal weather conditions during the Interim period. Interim period success criteria are as follows:

- *Wetland and riparian areas monitored under this EMP will maintain hydrologic functions and will continue to support wetland / riparian plant species.*
- *Wetland and riparian areas monitored under this EMP will continue to meet the California Coastal Commission one-parameter definition of wetland habitat and will exhibit evidence of native plant recruitment and wildlife usage.*

These criteria are based on maintenance of groundwater depth and salinity levels at or near baseline conditions during decommissioning, such that rapid changes in vegetative composition do not occur. If vegetative loss or change is noted during Interim period monitoring visits, remedial actions will be taken to address the problem.

Long-term Success Criteria

…The success criteria for the Long-term monitoring effort consist of the following requirements:

- *Species composition, percent cover, and wetland/riparian acreage as document at each site during annual monitoring efforts will remain within 25% of the baseline conditions over the life of the project (after allowance for annual weather variations). Wetland and riparian areas monitored under this EMP will maintain hydrologic functions and will continue to support wetland / riparian plant species.*
- *Wetland and riparian areas monitored under this EMP will continue to meet the California Coastal Commission one-parameter definition of wetland habitat, and will exhibit evidence of native plan recruitment and wildlife usage.* (See Cited Document 70, pp. 72, 73.)

Even when the RWMP provides what sound like more specific criteria (e.g., the "Interim" and "Long-term Success Criteria" above), the parameters ("25% of the baseline") allow significant adverse impacts. Given the dynamics and uncertainties of basin hydrology, purveyor and private pumping of the basin, the slow time frames for some impacts to appear, weather patterns and related environmental changes (including climate change and sea level rise); the County will be able to explain away virtually all adverse changes, especially long-term effects, as resulting from other causes.

The following passage from the RWMP indicates how easy it will be to rationalize inaction and avoid accountability.

> *If negative trends or subsequent failure to meet the success criteria occur, such trends are expected to occur slowly over several years, and will likely take equal or more time to reverse. Identified problem areas will be addressed through the Adaptive Management analysis to identify suitable remedial action.* (See Cited Document 70, p. 87.)

I.E.2.d.v. The RWMP "Reporting and Adaptive Management" program does not mitigate for impacts on seawater intrusion and sensitive habitat and shows mitigation is infeasible. When the Commission approved the project, adding Special Condition 5 to address "substantial issues," it relied heavily on adaptive management to address potential adverse groundwater impacts. However, adaptive management (contingency planning) does not avoid or minimize impacts unless measurable performance criteria are identified, a range of specific, feasible mitigation options. Successful mitigation also requires the agency developing the project to be committed to mitigation. These basic criteria are not met with the LOWWP. (See Section I.E.2. j. for further discussion of the County and CCWQCB failure to commit to mitigations.)

Essential assessments were deferred (groundwater flow measurements to creeks), no feasibility analysis was done (e.g., a worse-case scenario), and feasible options were not identified to address the range of possible project impacts, e.g., contingency measures for Broderson leach fields if they fail and/or farmers opt out of a recycled water program. Evidence supports that back up measures were not identified because they are not feasible; the failure of the RWMP to identify feasible options supports that conclusion. Thus, the project is not mitigated despite the CDP requirement for an adaptive management program.

The CSUMB Watershed Institute Los Osos report, which the LOSG submitted to the Commission at the January 2010 hearing, provides the following recommendations for adaptive strategies in LOWWP:

> *Because there is likely to be a time delay between project implementation and its potential impacts to some basin groundwater systems and because management options, such as strategies to supply water to wetlands and respond to seawater intrusion in the upper aquifer, require considerable lead time—it is advisable to take the following actions:*
>
> *a) B<u>e conservative in mitigation plans and err on the side of doing too</u> much rather than too little to prevent, rather than respond to, impacts such as increased seawater intrusion,*
>
> *b) Set up monitoring protocols for early detection, and*
>
> *c) <u>Develop a range of options that provide maximum flexibility (including a full range or water conservation and water re-use options) to respond early</u> to signs of*

groundwater contamination by salt water or other project/management plan impacts. (See Cited Document 57, p. 56.)

The CSUMB report Identified four priority areas for contingency planning, which addressed the "primary uncertainties" of the project: "…the performance of the Broderson leach field, saltwater intrusion in the upper aquifer, increased saltwater intrusion in the lower aquifer, and the environmental impact on wetlands, creeks and environmental resources." (See Cited Document 67, p. 57.) The Report recommends asking questions to guide planning. The questions clearly show why it was necessary to identify a range of feasible options prior to project approval.

3.9.2 Priority Zone 1: The Broderson Leachfield Disposal Capacity

…

Contingency Measures:

Are there other disposal locations that could supplement the Broderson site if it is unable to handle the load requirements?

What are the best alternative locations and why are these preferred?

Could more recycled water be directed to urban reuse, agricultural reuse, and wetlands to reduce the need to dispose of recycled water at the Broderson site? … (See Cited Document 67, p. 59.)

3.9.3 Priority Zone 2: Capacity of the Upper Aquifer to Resist Salt Water Intrusion

…

Contingency Plan:

What are the performance criteria that will be used to evaluate whether the project is having negative impacts on salt water intrusion?

What are the benchmarks that will be used to determine the safe yield of the upper aquifer and to flag the beginning signs of salt water intrusion?

What contingency measures can be taken if there are signs of salt water intrusion into the upper aquifer?

How many AFY can an LID system provide to infiltrate rain water into the upper and/or lower aquifer? How much water can be collected water (sic) *from hillside runoff, roof tops or impervious surfaces? How many AFY would grey water systems for recharge or outdoor watering save?...* (See Cited Document 67, p. 62.)

These questions clearly point out the kinds of specific questions that should have been asked prior to project approval. Although the Commission Staff requested the County in January 2010 to provide greater specificity in proposed groundwater measures to address significant issues, the County provided virtually no specificity in its 900 page response. Instead Mark Hutchinson, the County Environmental Coordinator exaggerated the potential of proposed measures to mitigate for the project, claiming that Broderson disposal was certain to work and reuse and conservation measures

provided back up for the measure. He also failed to point out the infeasibility of options, e.g., multiple leach fields. (See I.E.2.a.iii.) As a result, the Commission failed to recognize that adaptive management would not mitigate for the project.

The RWMP continues to provide inaccurate, erroneous, and incomplete information suggesting that Broderson and Bayridge leach field disposal can be adjusted to mitigate for impacts on habitat:

> *Construction of the LOWWP will decommission existing septic systems, thereby removing localized groundwater discharge sources that are spread relatively evenly throughout the community. Following construction of the LOWWP, discharges of tertiary treated water to the upper aquifer will occur at two primary locations (Broderson and Bayridge Estates). The quantity of discharge will require adjustment to ensure adequate groundwater levels are maintained throughout the community.* (Emphasis added) (See Cited Document 70, p. 69.)

The RWMP further fails to mention the significant potential adverse impacts to Los Osos Creek, a focus of the Condition 20 monitoring and management plan for the prior project, although RWMP bases many statements related to habitat mitigation on the earlier plan. The RWMP's reliance on the earlier plan is clearly shown in the brief discussion of specific adaptive measures for wetlands.

> *If negative trends or subsequent failure to meet the success criteria occur, such trends are expected to occur slowly over several* years, and will likely take equal or more time to reverse….
>
> - *Adjusting harvest well quantities to raise or lower groundwater levels;*
> - *Artificial watering of wetland areas by water truck or fire hydrant;*
> - *Redirection of road or storm drain runoff to nearby wetland areas;*
> - *Removing sediment deposits in wetland areas to allow ponding to occur; and,*
> - *Removal of non-native or invasive vegetation*. (Emphasis added) (See Cited Document 70, pp. 87 & 88.)

CDP Condition 20, the monitoring and management plan for the prior project states:

> *It is anticipated that if impacts do occur, they will occur slowly and will take equal or more time to reverse. Since potential impacts will be related to a reduction of groundwater levels, such measures are likely to involve reducing harvest well quantities during dry months, artificial watering of wetland areas, redirection of road or storm drain runoff to nearby wetland areas, removing sediment deposits in wetland areas to allow more ponding to occur, and removal of non-native vegetation.* (See Cited Document 3, p. 20.)

Clearly, the Condition 20 plan was consulted; however, the RWMP makes no mention of impacts to Los Osos Creek, a focus of the earlier plan. (See Cited Document 3, p. 13.) The RWMP does not even provide monitoring stations at Los Osos Creek or Los Creek Estuary. (See Cited Document 70, pp. 69-

74.) The fact the RWMP lists infeasible contingency measures highlights the infeasibility of mitigating for impacts to sensitive habitat. (As discussed, harvest wells are prohibited in the CDP and "artificial watering" is infeasible due to its impacts on seawater intrusion--see Cited Document 60, Condition 1-j.) The above provides clear evidence that officials continue to provide inaccurate, erroneous, and incomplete information crucial to decision making.

The RWMP "Reporting and Adaptive Management Program" further shows that the County is not committed to mitigation with the following provisions:

> *SECTION 5: Reporting and Adaptive Management Program*
> *5.1 Introduction*
> *Monitoring the groundwater basin over time as it continues to change due to modifications in pumping and reuse will provide the County, the Water Purveyors and other interested parties the ability to make adjustments to the management of the Basin.*
>
> *5.2 Purpose and Objectives*
> *The purpose of the Reporting and Adaptive Management Program is to provide the final "check and balance" for the Recycled Water Management Program to ensure that the overall objectives of the groundwater basin are being met. Evaluating the groundwater basin on an annual basis allows the County to:*
> …
> - *Modify pumping, treatment and/or reuse procedures if groundwater basin trends are showing signs of degradation of water quality, including increased levels of contamination and/or increased levels of seawater intrusion.* … (See Cited Document 70, pp. 79, 81 & 82.)

Thus, the County will rely on "Water Purveyors and other interested parties" to mitigate for impacts. Again, the County has ability to enact an ordinance to direct changes in water use and pumping practices basin-wide, but the RWMP indicates the County does not plan to use that authority. (See Section I.E.2.j.)

Both Eugene Yates and the CSUMB Watershed Institute recommended well-designed monitoring and adaptive management programs mitigate for the project. However, they did not have accurate information about the community's water use (i.e., limited conservation potential). The Watershed Institute also did not know seawater intrusion had accelerated by 12 times. Further, both recommended additional assessment and evaluations prior to project approval to determine a range of the most effective ("sustainable") mitigation options, (See Cited Document 67, e.g., pp. 61 & 68 and Cited Document 36, p. 4 & 5.)

The CSUMB report further points out that the time scales involved in groundwater mitigation make effective adaptive management unlikely:

The long timelines involved in most groundwater basins, as in the Los Osos basin, pose problems for realistic monitoring programs by public agencies. Over periods of twenty or thirty years, most personnel in public agencies, private consulting firms, and politics will have retired, so the transfer of knowledge crucial to effective program implementation may not occur. Similarly, budgets do not often earmark expenses on those timelines, and the political will to fund monitoring programs requested decades earlier may disappear. (Emphasis added.) (See Cited Document 67, pp. 34.)

The RWMP provides substantial evidence the project is not mitigated and cannot be mitigated. It further shows that the RWMP "Reporting and Monitoring and Adaptive Management Program" provide the County, the CCRWQCB, and other agencies (e.g., the SWRCB) a way to avoid mitigating for impacts--and/or a finding of overriding consideration. Such finding would not be justified because it means allowing a project that is supposed to protect resources to harm those resources. Any written finding of overriding consideration would clearly show the project's adverse impacts outweigh its benefits.

Further, a finding of overriding consideration would most likely be made on the basis that the project is required by Resolution 83-13. This would have highlighted the fact that the Resolution results in greater environmental harm than good, and should not be used to guide review process. The LOWWP and Resolution 83-13 are presented as environmental remediation measures. Thus, officials would run into legal and political issues if they presented them any other way. (See Section I.E.3.a. and Part IV.C. for further discussion of Resolution 83-13 and why overriding considerations are not justified.)

(Note: Conditions 88, the voluntary septic systems conversion program designed to restore flows to habitat, is not mentioned in the RWMP, although the Condition 20 adaptive management plan for the prior project included the provision. Condition 88 does not mitigate for project impacts for two main reasons. As a voluntary program, it does not provide specific, measureable, or enforceable benefits. Further, will not be effective because most of the rainwater falling on individual properties already percolates to groundwater due to the sandy soils in Los Osos. This is confirmed by the Yates and Williams 2003 study. (See Cited Document 34, p. 6.). Directing rain gutter downspouts to abandoned septic systems in an effort to replace septic systems recharge, at most replaces the rainwater recharge currently percolating to the groundwater from roof tops. The measure also could pollute the groundwater by flushing nitrates from the upper layers of the soil over a relatively short period of time.)

I.E.2.e. The project will have severe indirect, cumulative, and socio-economic impacts, not addressed or mitigated, which could lead to severe (even catastrophic) environmental impacts.

I.E.2.e.i. The project in conjunction with the purveyor (ISJ) "Basin Plan" and management measures will have indirect and/or cumulative adverse impacts on the basin, sensitive habitat, and human health and safety. (The project is most likely already having indirect adverse impacts by delaying purveyor management measures needed to stop seawater intrusion, e.g., pumping shifts to the upper aquifer.)

The project will significantly alter and reduce recharge of the upper aquifer at the same time purveyors plan to shift much more pumping to the upper aquifer to reduce lower aquifer pumping and address seawater intrusion. The unmitigated adverse impact on the basin from the use of Broderson leach fields will be substantial due to the liquefaction risk and time delay in aquifer recharge. Major shifts in pumping to the upper aquifer substantially increase those potential impacts by substantially reducing the amount of water in the upper aquifer, increasing the risk of seawater intrusion. Eugene Yates confirms this cumulative impact in his June-August 2010 review of the Basin Update. (See Cited Document 35, pp. 1&2 and Section I.E.2.l., Table 1.)

Purveyors are also considering shifts in pumping inland and production from shallow aquifers (Zones A & B) to address the critical seawater intrusion problem. (See Cited Document 47, p. 5.) As discussed in other sections (e.g., Sections I.E.2.b. and I.E.2.c.i.), the project will substantially reduce recharge to the shallow aquifers, causing unmitigated adverse impacts on private wells and sensitive habitat (e.g., Willow Creek and Los Osos Creek). Shifts inland to any aquifer (Zones A-E) could have cumulative adverse impacts by further reducing groundwater flows to sensitive habitat and/or forcing private well owners to use deeper aquifers causing adverse impacts to those aquifers. Since groundwater (especially in Zones C-E) flows in a westerly direction, more pumping from the eastern part of the urban basin will reduce water levels in the western basin. As Eugene Yates points out, shifting pumping does not provide a long-term fix. (See Cited Document 36, p. 4.)

Because the project has potential adverse impacts on the upper aquifer, shallow aquifers, and habitat; purveyors will likely avoid or delay major shifts in pumping, also delaying cooperative nitrate treatment, blending, and intertie agreements needed to make the shifts and optimize basin management. This indirect impact will have (and is likely already having) adverse impacts on seawater intrusion in the lower aquifer. It will also have adverse impacts on all aquifers in the future because basin management will continue to be uncertain if the project is installed since basin systems will not stabilize for 30 to 60 years.

Purveyors state in the Basin Update that "quick and decisive action must be taken to address the (seawater) intrusion" and they agree that major shifts in pumping are needed. (See Cited Document 47, pp. 4 & 5.) The 2009 ISJ Urban Yield tech memo shows basin sustainability depends on purveyors shifting pumping to the upper aquifer. (See Cited Document 74, e.g., pp. 6 & 7.) Eugene Yates, in June of 2010, recommended "immediate" shifts of "most" urban area pumping to the upper aquifer, pointing out that nitrate treatment is "inevitable." (See Cited Document 35, pp. 1 & 6.) Shifting most of the pumping to the upper aquifer requires purveyors to have cooperative treatment, blending, and

intertie agreements in place. However, a recent CCRWQCB update of the ISJ process reports that purveyors put cooperative measures on hold indefinitely. (See Cited Document 46, e.g., pp. 2 & 3.) To some extent, failure to arrive at cooperative arrangements is likely due to purveyors' knowing the project will have adverse impacts on the upper aquifer.

Delays in the release of a draft purveyor Basin Plan provide evidence the project is adversely affecting the process. The draft plan has been postponed three times in three years. (It was due out December 2009, 2010, and 2011 but is still not released.) The County has been a member of the ISJ since 2008, and the CCRWQCB has provided ISJ updates since 2009. Thus, agencies are aware that the project is having indirect and/or cumulative impacts on the basin--but they did inform the Commission. (See further discussion in Section I.E.2.e.iii below.)

I.E.2.e.ii. The Recycled Water Management program, conservation program, adaptive management program, storm water management program, and sewer hook up program (including septic system decommissioning) will have significant indirect and/or cumulative adverse impacts. All of these programs have potential adverse impacts that add to the impacts of the LOWWP. The impacts—and the potential for avoiding them--should have been analyzed and addressed prior to project approval. Impacts remain unmitigated due to the failure of the County and CCRWQCB to disclose the impacts. Analyses would have shown project adverse impacts outweigh its benefits, and less harmful, feasible alternatives are available.

A recycled water program will have potential adverse effects on the aquifers and habitat due to the high salt content of the water and other contaminants, including emerging contaminants. These could adversely affect farming aquifers and soils, as well as sensitive habitat. Cumulative and/or indirect impacts will also result from under use of the program, requiring construction of additional facilities and or treatment to provide adequate disposal capacity and mitigation for seawater intrusion. (Also see Section I.E.2.d.ii.)

Conservation has substantial positive impacts, including that it is the most effective mitigation for seawater intrusion, which must be factored into decision making. It improves septic system function by reducing the rate of discharge, reduces the pumping causing seawater intrusion, reduces of GHG emissions, lowers homeowner energy costs, and results in less wear and tear on water supply systems. On the other hand, it could reduce (and may already be reducing) basin outflows increasing the risk of seawater intrusion in the upper aquifer. It could also reduce freshwater flows to habitat, raise the concentrations of nitrates and salts in recycled water, and increase blockages and overflows in a gravity wastewater collection system.

The project's adaptive management programs will have indirect and cumulative impacts. These programs have not been developed and may not be feasible, but if/when they are developed (e.g., measures to restore flows to habitat) they will have cumulative construction and related impacts. If they are not developed, the project will also have adverse impacts (Also see I.E.2.d.v.)

The storm water management program (SWMP) will have benefits for the estuary and creeks by helping to recharge the basin, maintain flows to habitat, stop pollution of the estuary, dilute groundwater contaminants, and control flooding of low lying areas (without the project.) However, with the project, its costs will further burden property owners and the program will likely go unfunded or underfunded resulting in long-term harm to surface waters, public health and safety risks, and/or CCRWQCB fines. These impacts also fall under the heading of socio-economic impacts (See I.E.2.d.iii. below.)

The EIR is vague on the issue of decommissioning septic systems and hook-ups, so the LOSG is not sure how much of the potential and unavoidable impacts have been factored into project impact estimates (e.g., in GHG emissions). However, the considerable potential adverse impacts appear to be unmitigated. The decommissioning of 4,500 septic systems and installation of that many laterals will have major impacts (potential and unavoidable) on the basin, ESHA, health and safety, and air quality/climate change. All of the prohibition zone is located in ESHA. Thus, installing laterals and decommissioning septic systems will disturb ESHA and protected species. Moreover, property owners will not be able to safely dig their own trenches since collection main lines will be buried at an average depth of eight feet. Trenching will require back hoe operation, dewatering (in some locations), shoring, and other safety measures. Adverse impacts on air quality and non-renewable resources are substantial, amounting to at least a third of the impacts of the collection system (about 2,500 tons of CO2e, 130,000 gallons of fuel, and well over a mile of 4" PVC piping.) Some people will attempt to dig their own trenches, risking injury from trench collapse. Trenching, back hoe operation, and construction has risks, significantly increasing the project's potential health and safety impacts.

The County and CCRWQCB were aware of these indirect and cumulative impacts, yet they failed to analyze and mitigate for them—or to inform the Commission of the adverse impacts.

I.E.2.d. iii. Project socio-economic impacts will have severe—even catastrophic--adverse impacts on the environment. The very high monthly costs of the project ($170 to $350 or more per homeowner--$238 average per SWRCB documents) will delay water management measures needed to stop seawater intrusion (e.g., cooperative nitrate treatment) and it could prevent essential measures altogether. Purveyors and customers will try to avoid higher costs utility costs, especially in a poor economy. Many homeowners will simply not be able to afford these costs.

County and CCRWQCB officials are fully aware the basin may not be sustainable under present conditions with seawater intrusion rapidly destroying the large lower aquifers. They are also aware that the sooner decisive action is taken to stop the destruction of basin, the more likely the basin is to become a sustainable water source for the area. The project diverts a tremendous amount of limited financial resources towards a project that makes basin sustainability less likely, draining resources for more cost-effective management measures. Moreover, delays in addressing seawater intrusion could result in other expensive, environmentally harmful projects to secure an alternative water source, including a desalination project or pipeline to import water from Lake Nacimiento or the State Water

Project. Additional public works projects will not only cause environmental harm in the area, but put still greater pressure on the the Sacramento Delta and local water supplies needed for other water-challenged communities.

Environmental harm resulting from socio-economic impacts will also result from homeowners being unable to afford a storm water management program mandated by the CCRWQCB to reduce surface run off pollution of the National Estuary. The current Los Osos storm water program is extremely weak consisting solely of educational measures. (See Cited Document 17, e.g., p. 3.). The Morro Bay National Estuary Program (MBNEP) ranks Los Osos storm water management among its highest priority projects. (See Cited Document 14.) The CCRWQCB will require a storm water management program (SWMP) to replace the conventional storm drain system, but residents will not be able to afford it.

Prohibition zone property owners will also not be able to afford the costs of unmitigated project impacts (discussed in I.E.2.) including the cost for higher levels of treatment (e.g., reverse osmosis) and/or other disposal options when/if the recycled water program proves nonviable due to high salt content. Property owners will also be unable to afford adaptive management measures when monitoring shows harm to habitat and the basin, and they will not be able to afford project repairs due to severe storms or earthquakes, leading to harm of the environment from overflows, leaks, and back ups from a damaged system.

The County and CCRWQCB officials are fully aware of these severe unmitigated socio-economic impacts, but did not inform the Commission. (Also see further discussion of socio-economic impacts in the Angel Law objection to the SRF loan-- Cited Document 25, Addendum, p. 10.)

I.E.2.f. The project will have severe adverse impacts due to earthquakes.

I.E.2.f.i. **Overview**: Los Osos is located in an earthquake zone near faults capable of an 8.2 magnitude quake. It is also located in a liquefaction zone, with highly liquefiable soils in much of project area. The DEIR finds that the project meets the threshold of significance for impacts—i.e., it will " Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death." (See Co DEIR F Geology, p. 5.4-14—p. 24 of the pdf.) However, the DEIR finds that impacts can be mitigated with a geotechnical report and an emergency response plan (see below). A report and plan do not mitigate for these extremely serious potential adverse impacts.

Dana Ripley, of Ripley Pacific Company, a respected engineer and designer of wastewater projects, states that the project does not mitigate for earthquake impacts and the County has simply taken a "do nothing and accept the risk" approach while also claiming it has fully mitigated for liquefaction hazards. (See USDA Ripley Let 10.05.11, p. 8.) Mr. Ripley is referring mainly to hazards associated with

earthquake damage to the collection system, but a close reading of the EIR reveals that his statements also apply to liquefaction caused by Broderson disposal to homes downhill from the site.

Recent disasters in Christ Church, New Zealand, and Fukishima, Japan show that earthquakes have catastrophic effects on conventional gravity collection systems located in liquefiable soils. Strong earthquakes in these cities forced manholes up through paved city streets, resulting in complete system failure causing major health and safety impacts. This type of catastrophic failure could cause massive releases of sewage into the estuary and homes, causing substantial harm to life and property. Liquefaction of the soil under homes downhill from the Broderson site could result in loss of life and substantial property damage. As the following evidence shows, the County and CCWQCB know these adverse impacts are not mitigated but failed to inform the Commission.

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I.E.2.f.ii. The project fails to mitigate for adverse earthquake impacts from the collection system on the environment and human health and safety. The DEIR "Expanded Geology Analysis," states

> *The proposed collection system…may experience significant liquefaction impacts. Furthermore, this potential significant impact could result in pipeline breaks and release of untreated and/or treated effluent along the proposed collection/conveyance system, including within Los Osos Creek and Warden Creek.*

Los Osos is located in an earthquake zone, near two faults capable of a force of 8.2 on the Richter Scale, according to USGS officials. The DEIR Appendix F agrees that the potential for significant impacts from the collection system exist due to highly liquefiable soils. (Co. Cited Document 6, p. 5.4-18.) However, the FEIR states that earthquake impacts on collection pipelines are usually not mitigated (See Cited Document 65, p. 17.) Like the DEIR, the FEIR recommends a geotechnical report:

> ***5.4-C1*** *Prior to approval of the improvement plans for the proposed facilities that are part of the collection system and at the treatment plant site, a geotechnical report that addresses liquefaction hazards shall be prepared and approved by the County of San Luis Obispo. The geotechnical report shall state the recommended actions for the collection system and treatment plant site so that potential impacts from seismically induced liquefaction would be reduced to less than significant.*
> ***5.4-C2*** *Prior to approval of improvement plans, an Emergency Response Plan (ERP) shall be prepared as part of the operation and maintenance plan for the proposed collection system. The ERP shall recognize the potential for liquefaction, seismic hazards and ground lurching, to impact the pipeline or other proposed facilities, and specific high hazard areas shall be inspected for damage following an earthquake. "Soft Fixes" shall be incorporated in the ERP. Soft fixes typically consist of having a plan in place to address the hazards, such as can be achieved by storing supplies and equipment for repair*.(emphasis added) (See Cited Document 6, p. 5.4-21.)

Thus, the EIR recognizes the potential for serious earthquakes but does not mitigate for the impacts because a report created after project approval does not meet CEQA standards for mitigation. Besides failing to ensure impacts are mitigated, a study after-the-fact precludes a fair comparison of alternatives. By failing to provide an adequate earthquake impact analysis,--just as with the air quality analysis that omitted construction GHG—the EIR shows a bias toward the conventional gravity system. Alternatives using septic tanks (e.g., STEP), including alternatives that leave septic systems in place (a comprehensive management program), greatly reduce potential adverse environmental and health and safety risks from earthquakes. The EIR inaccurately states the potential adverse impacts of an earthquake on the conventional gravity collection system and the low-pressure STEP system "would be the same." (See Cited Document 6, p. 5.4-19.) Obviously

a conventional gravity system with rigid piping and unsealed joints requiring exact gradients to function properly, which does not provide reserve capacity on site, is an inferior system in an earthquake zone.

I.E.2.f.iii. The project fails to mitigate for adverse earthquake impacts on homes downhill from the Broderson site. A study prepared by Cleath and Associates for the LOCSD in 2000 on the Broderson disposal site concludes, "The potential for liquefaction of the finer grained sediments in Horizon A will exist beneath the residences north of the site" (See LOCSD Broderson Sty, 2000, p. 19). The study explains that the increased potential is "based on the possibility for Horizon A to saturate as perched water moves off site," and it refers to a study by 1996 Fugro West report, which found that perching and saturation could occur even if groundwater levels did not rise above 80 feet "…if the rate of infiltration locally exceeds the soil permeability" (Emphasis added) (See Cited Document 91, pp. 16 & 17). The Cleath and Associates study is clear that the potential for liquefaction exists regardless of disposal rates:

> *"…Horizon A will become saturated offsite, and the potential for liquefaction of this horizon will exist in an area where it did not before. Even if greater setbacks were used or lower disposal rates were used, Horizon A will still potentially be saturated off-site to the north."* (See Cited Document 91, p. 17.)

The DEIR (Appendix D-2; Cited Document 38), prepared by Hopkins Groundwater Consultants, states that the 2002 Cleath and Associates study "speculated that at any discharge rate, there may be increased potential for liquefaction beneath residences…" (Emphasis added). The Hopkins analysis (Appendix D-2; Cited Document 9) then goes on to summarize findings in a subsequent 2004 Fugro West study prepared for the LOCSD, as follows:

> *The underlying Paso Robles Formation is weakly indurated and forms a dense soil that has a low potential for liquefaction or seismic settlement to occur as a result of the effluent disposal system and the estimated groundwater mounding beneath Broderson (Fugro, 2004)."* (See Cited Document 38, p. 32 and Cited Document 39, p. 6.)

This avoids the issue Cleath and Associates and the 1996 Fugro West reports raise, i.e., liquefaction can occur due to movement of water offsite during disposal rather than as a result of mounding (rising groundwater). Hopkins Consultants avoids directly stating that saturation of Horizon A will not result in liquefaction, but the DEIR Appendix F ("Expanded Geology Analysis") prepared by Brandman and Associates explicitly states that no potential for liquefaction exists with saturation of Horizon A:

> *Thus even in the event the near surface loose dune sand were saturated due to precipitation or effluent disposal at the time of an earthquake, the groundwater depths would not rise near the ground surface at the site. Therefore, the proposed facilities at Broderson would not*

change the potential for liquefaction or seismic settlement to occur within the soils ***because of*** *the effluent disposal system* ***and estimated mounding at the Broderson site*** (emphasis added). (See Cited Document 6, p. 5.4-19.)

A careful reading again shows the statement avoids the specific issue Cleath and Associates and Fugro West raise in 2000 and 1996 (the liquefaction risk increases with saturation of Horizon A even if groundwater does not mound) since liquefaction can occur in perched water. In fact, much of the liquefiable soil in the community is due to perched water (e.g., under Paso Robles Avenue).

The FEIR Appendix Q ("Preferred Project Environmental Evaluation") prepared by Brandman and Associates using a Fugro West report (May 22, 2008) (which cites the 2004 Fugro West report) restates that liquefaction will not occur at the Broderson site, and it finds no significant impact. (See Cited Document 65, pp. 19 & 29.) However, the 2008 Fugro West/Brandman report is unsigned and labeled "DRAFT—DO NOT RELY ON THIS DOCUMENT" (See Cited Document 65.)

The convoluted trail of the Broderson liquefaction issue goes as follows: A 2000 Cleath and Associates report, citing a 1996 Fugro West report, finds a significant increased risk of liquefaction under homes with Broderson disposal due to the saturation of Horizon A. The DEIR groundwater analysis (Appendix D-2, Hopkins Groundwater Consultants) states that Cleath and Associates "speculated" the impacts. The FEIR (i.e., Brandman and Associates) using a 2008 Fugro West report (based on a 2004 Fugro West report contradicting a 1996 Fugro West report) finds no significant impacts from liquefaction at the Broderson site. All EIR reports avoid the issue the Cleath and Associates 2000 report raises (increased risk of liquefaction with saturation of Horizon A due to perched water), and the FEIR relies on a 2008 Fugro West/Brandman report labeled "DRAFT—DO NOT RELY ON THIS REPORT."

The FEIR "Section 4: Errata" (Appendix F-1; Cited Document 92) adds a mitigation measure for Broderson leach fields: "…a design-level geotechnical report…that addresses and reduces potential expansive soil impacts to less than significant" (Emphasis added.) (See Cited Document 28, p. 4-24.) This deals with "expansive soils" not liquefaction, and a "geotechnical report" is not mitigation, so neither the potential adverse impacts from liquefaction nor expansive soils are mitigated.

Clearly, EIR consultants and the County were fully aware of potential earthquake impacts from Broderson disposal. There have been at least four studies and the EIR addresses them in at least three places. The Hopkins report statement that Cleath and Associates "speculated" impacts, the nuanced EIR language sidestepping the issue, and the FEIR's reliance on an unsigned 2009 Fugro report, all support that the County knows this impact is unmitigated, but withheld the information.

Furthermore, Roger Briggs, Executive Director of the CCRWQCB raises the issue in his DEIR comments, pointing out the increased potential for liquefaction under homes near the Broderson site is of particular concern during winter months when almost all effluent from the project is percolated at the

site along with all rainwater falling/flowing onto the site. (See Section I.E.2.c.v. above and Cited Document 13, pp. 4 & 5.) This information further supports that the County and CCRWQCB were aware of the severe potential impact in June 2010, but did not disclose the information to the Commission.

Although not identified as a mitigation measure for liquefaction, the LOWWP provides for monitoring near the Broderson site to address the potential for daylighting water and mounding. However, monitoring is not mitigation and Broderson disposal has no back up. The disposal measure is the main groundwater mitigation measure, intended to replace groundwater flows in the upper aquifer, the lower aquifer, and very high value habitat below the site (Sweet Springs Marsh)—so the project is unmitigated without back up. Further, the project lacks sufficient disposal capacity without Broderson. Thus, if soils become saturated and liquefiable at some point during the operation of Broderson after septic systems are decommissioned, Broderson disposal would have to continue despite the serious risk to life and property should an earthquake hit the area.

The amount of study on this potential impact and the fact that it remains unmitigated, supports a conclusion that it cannot be mitigated (i.e., Broderson cannot be operated without causing a significant increased risk to life and property downhill from the site). Therefore, the unmitigated impact could be a fatal flaw in this mitigation measure and the project. Additionally, severe impacts from a serious earthquake on the collection system cannot be feasibly mitigated and a risk-cost-benefit analysis was not done. The County and CCRWQCB officials know this and decided not to disclose the risk to the Commission; instead they claimed there is no risk.

In his response to Commission Staff regarding substantial issues, Mark Hutchinson, County Public Works Environmental Program Coordinator, states "…extensive testing and analysis has led to a project description that avoids all potential adverse impacts from Broderson leach fields." (See Cited Document 58, p. 10.) The Draft Recycled Water Plan (RWMP) continues to hide the liquefaction impact, citing a portion of the Cleath and Associates 2000 study, again avoiding the issue: "The study concluded that 'daylighting will not occur at this disposal site between Highland Drive and Los Osos Valley road due to mounding or lateral movement of the water along the shallowest perching horizon.'" (See Cited Document 70, p. 24.) Thus, the RWMP quotes a finding that, at first, appears to address the Horizon A liquefaction question, but, in fact, deals with "daylighting." This provides further evidence of a pattern of intentional fail to disclose impacts.

[Also see further discussion of earthquake (ground movement) impacts Angel Law objection to the SRF-- Cited Document 25, Addend, pp. 11 & 12.]

I.E.2.g. The project will have severe adverse impacts due to GHG emissions.

The EIR air-quality/climate change analysis is seriously flawed and biased toward the approved project. The County and CCRWQCB knew of this flaw/bias in June of 2010 but did not inform the Commission.

The DEIR finds that the LOWWP has no adverse cumulative impacts from GHG emissions, stating "Since Proposed Projects 1 through 4 could reduce GHG emissions compared to the existing wastewater system (septic systems), implementation of any of the proposed projects would not contribute to an adverse cumulative impact related to GHG emissions." (See Cited Document 109, p. 5.9-75.) The FEIR "Errata" amends the statement slightly stating "Since Proposed Projects 1-4 would increase GHG emissions during construction activities and could reduce long-term GHG emissions compared to the existing wastewater project. (sic) Proposed Projects 1 through 4's contribution to GHGs emissions is considered less than cumulatively considerable, and thus result (sic) in a less than significant impact." (See Cited Document 28, p. 4-31.) The "Errata" also amends the total estimated construction emissions to 7,700-8,000 metric tons of Co2e per year from about 4 million metric tons, and it amends the operation emissions to about 940 metric tons per year from 170,000 metric tons. (See Cited Document 109, pp. 5.9-64 and 5.9-65 and Cited Document 28, 4-29 and 4-31.)

However, the FEIR finding is flawed. According to the FEIR "Errata," the "net difference" (reduction) of GHG in the operation of proposed projects (including the LOWWP) is 102 metric tons per year (See Cited Document 28, 4-31.) Thus, the LOWWP would not "reduce long-term GHG emissions" for 75-80 years (7,700 to 8,000 tons/100 tons). By the year 2020 (the year AB 32 goals are supposed to be met) the project would cause a net increase in GHGs of 7,200 to 7,500 metric tons (assuming project start up in 2015.) This clearly is not consistent with the AB 32 goal of a reduction of GHG to 1990 levels by 2020.

Moreover, the County failed to inform the Commission that a study released in 2009 by the Water Environment Research Foundation (WERF) found that GHG's release from septic tanks are half the amount assumed in the EIR. (The EIR calculation is based on the IPCC estimate--see Cited Document 108.) The WERF finding reduces the EIR GHG estimate for the current system (septic systems) by about 300 metric tons per year (half of the 624 metric tons assumed for the operation of STEP tanks for Project 1). This would reduce the total yearly estimate to about 630 metric tons, making the operation of current septic systems about 75% of the estimated operation of the LOWWP (839 metric tons). (See Cited Document 28, pp. 4-29 and 4-31.) The EIR also assumes septic systems are pumped every five years; whereas the average pumping rate in the county is every ten years. Therefore, not only does the project result 8,000 metric tons of GHG emissions during construction, but it results in about 25% more emissions from operations (about 200 metric tons per year or 6,000 to 8,000 metric tons over the life of the project, assuming a 30-40 year project life). Thus, the project results in a cumulative impact of 14,000-16,000 tons of additional emissions over the life of the project, with an increase of about 9,000 tons by the year 2020 (i.e., 8,000 tons plus 5 years X 200 tons).

In his DEIR comments, Daniel Berman, Director of the Morro Bay National Estuary Program (MBNEP) points out that the DEIR relies on a technicality in AB 32 to justify excluding construction GHGs in the an alternatives analysis. As he aptly notes that construction impacts must be included for an analysis to be consistent with the bill.

> *The standard used in the DEIR for assessing the significance of GHG emissions effectively ignores all construction emissions as inherently insignificant, since AB32 compares 1990 emissions with 2020 emissions. (App K, pg 5.9-69, paragraph 2) This seems like a clear example of following the letter of the law and not the spirit, and it would be unfortunate if this becomes the standard analysis approach for CEQA. The law was enacted because GHG emissions create long lasting disruptive effects on our climate. It is cumulative emissions over time that causes the problem. In this project, the differences in construction emissions between projects are relatively small. But as a CEQA approach, it seems misguided to only consider differences in ongoing operational emissions and ignore differences in* ***total*** *(short and long term) GHG emissions between project alternatives.* (emphasis added) (See Cited Document 29, p. 3-436.)

The 2001 FEIR for the previous Los Osos project supports Mr. Berman's point. It finds construction impacts to be a significant, unavoidable impact:

> *Construction emissions would exceed the APCD's significance thresholds for NO2 and PM10 and are considered a significant impact to regional air quality. Combustion emissions generated by construction would degrade local air quality and contributed to exceedances of the nitrogen dioxide (No2) 1-hour state air quality standard. This impact cannot be mitigated to a level of less than significant; therefore, it is considered Class I, significant and unavoidable."* (Emphasis added) (See Cited Document 66, p. 82.)

By considering only operational GHG emissions during the alternatives analysis/environmental review, the County failed to fairly evaluate alternatives, which leave some or all septic systems in place (including a comprehensive management alternative). As shown by the changed finding in the Errata, the County knew the EIR should have accounted for construction impacts to comply with AB 32. However, the County (FEIR) provided a flawed finding after the fact claiming the project had no significant impacts. The County then failed to provide the Commission updated information from the WERF study that would have highlighted the flawed finding. The County and CCRWQCB officials were aware of the EIR's failure to identify air quality/climate change impacts and comply with AB 32 in June of 2010. Agency officials were also aware that alternatives retaining septic systems in place would substantially reduce impacts. However, the agencies did not inform the Commission.

I.E.2.h. The project will have severe adverse impacts due to growth inducement.

The very high cost of the project in combination with the manner in which assessments were structured (on the assumption that build out would occur, then revised so that current homeowners pay undeveloped property assessments) will drive unsustainable growth causing severe unmitigated impacts. The cost of the project is so high for individual proper owners ($150 to more than $350) that property owners and government officials will support growth despite an over drafted basin and seawater intrusion to lower sewer assessments. County officials recently told the public and local realtors that basin water supplies will enable additional building although seawater intrusion continues to rapidly move through the basin destroying the water supply. Further, a County flier provided to the public prior to the rates and charges protest hearing in December of 2010, presented cost estimates to homeowners showing a 25% reduction in homeowner costs if undeveloped property owners within the prohibition can build. (See page from flier presented a community meeting and the Board of Supervisors meeting December of 2010— Cited Document 79, pp. 9 & 10 of pdf.)

As a member of the ISJ, the County sponsored and supported the ISJ draft conservation plan, submitted to the Commission in December of 2011 to comply with Special Condition 5b, which has eight of 31 measures designed for new development and which shows development beginning by 2015 (well before the groundwater impacts of a project are known). The County signed and agreed to SWRCB SRF loan conditions, which state that the project treatment plant is sized for build out, but makes no mention that seawater intrusion threatens the water quality of the basin and may prevent build out (See Cited Document 93, e.g., pp. 4-7.).

The CCRWQCB WDR also states the project is sized to allow build out, does not mention seawater intrusion affecting water quality, and fails to mention CDP project conditions in the document, including Condition 8 requiring “conclusive evidence” that an adequate water supply is available before development can occur. (See Cited Document 11, p. 2, 9, and Special Condition 6, Cited Document 62, p. 10.)

The County and CCRWQCB have not supported septic management as provided in Resolution 83-12 issued prior to Resolution 83-13. A key difference between the resolutions is that Resolution 83-13, and a centralized project, will allow more build out. The County and CCRWQCB officials have known build is the only significant “benefit” from the project, but they did not disclose this fact to the Commission. (See further discussion of growth inducement impacts Angel Law objection to the SRF loan-- Cited Document 25, Addendum, p. 10.)

I.E.2.i. The project will have severe adverse impacts due to the failure of the County and CCRWQCB to commit to project mitigation.

I.E.2.i.i **The County has shown a failure to commitment to project mitigation and basin sustainability in the following ways:** 1) by providing inaccurate, erroneous, and incomplete information that withheld severe unmitigated impacts and overstated the benefits of the project, 2) by handing off mitigation and basin management responsibilities to water purveyors, 3) by burying the public and responsible agencies in mountains of documents that restate inaccurate, erroneous, or incomplete information, 4) by hiring local consultants who have had any experience with Los Osos projects to prevent them from weighing in against the project, and 5) by promoting building in the Los Osos area at the expense of a sustainable water supply.

Basically, the County preselected a project then engaged in strategy of "changing minds, not the project." The County's failure to commit to basin sustainability continues a long history of neglecting basin management (including septic system management), ignoring or downplaying seawater intrusion, and promoting unsustainable growth. The County's failure to commit to project mitigation and to the sustainability of the basin provides an important reason the project permit should be revoked to protect and preserve coastal resources.

The County has failed to commit to project mitigation and basin sustainability by providing inaccurate, erroneous, and incomplete information that withheld severe unmitigated impacts and overstated the benefits of the project. The evidence we provide in this Request shows that the County intentionally withheld information showing severe potential adverse impacts on the water supply, ESHA, public health and safety, and air quality. (See Section I.E.2.). The County also substantially overstated the benefits of project. (See Sections I.E.1.) Unmitigated adverse impacts include severe earthquake, growth inducement, air quality, cumulative and socio-economic impacts that add to the severity of impacts and could cause loss of life, major property damage, and catastrophic consequences for the area. (See Sections I.E.2.e. and I.E.2.f.). Overall, the County has withheld information showing the project will do more harm than good to resources (See Part II.) In failing to disclose and mitigate impacts, the County violated Coastal Commission Administrative Regulations, the Coastal Act, CEQA, NEPA, and other laws and regulations, which require agencies to address all significant adverse impacts, to identify the least-harmful feasible options/alternatives, to base decisions on substantial evidence, and/or to provide accurate, complete, and relevant information as soon as possible to other agencies and the public.

The County is failing to mitigate for the project and manage the basin by handing off mitigation and basin management responsibilities to water purveyors. County officials have repeatedly told the public and reviewing agencies that the LOWWP is a "wastewater project," not a water project," also inaccurately claiming that basin management and stopping seawater intrusion is the responsibility of the purveyors and Los Osos residents, not the County. "Topical Response 3" of the FEIR states the

County's position. In response to concerns that the project would not mitigate for seawater intrusion, the FEIR states.

> *These comments seek to expand the LOWWP beyond solving the wastewater issue and do not recognize the cooperative efforts between the water purveyors and the County under the Court approved Interlocutory Stipulated Judgment; which is guiding resolution of the existing groundwater litigation. Seawater intrusion is occurring and must be resolved. The LOWWP will reduce the existing rate of seawater intrusion. Nevertheless, expanding the wastewater project to incorporate other programs will repeat the LOWWP history of trying to do too much and then risking not funding and constructing the project as a result of further delays. RWQCB sanctions could also occur. Developing a wastewater project is the single most important issue to addressing the greater water resource problem, and solving the water resource issue requires completing a wastewater project. The County's wastewater project approach is to develop a project that provides the County, the water purveyors and the community with the ability to solve the water resource issue…*
>
> *The LOWWP approach to seawater intrusion is established in the project objectives: "Address water resource issues by mitigating the Project's impacts to saltwater intrusion. Furthermore, the wastewater project will maintain the widest possible options for beneficial reuse of treated effluent." Draft EIR Section 5.2, Groundwater Resources, together with Appendix D; clearly describes the magnitude of the project's seawater intrusion impact together with the measures that will fully mitigate this impact. The Broderson leachfield site is anticipated to provide 99 acre feet/year of seawater intrusion mitigation; the conservation program would provide 88 acre feet/year of seawater intrusion mitigation. Given that the LOWWP would have a seawater intrusion impact of 90 acre feet/year, the project would provide approximately double the needed mitigation amount. (See Draft EIR Section 5.2, Groundwater Resources; Draft EIR Appendix D, Groundwater Quality Resources; and the Fine Screening Report's Sections 2.2 through 2.4.) Consequently, each mitigation effort (Broderson or conservation) provides back-up for the other. The LOWWP does not in any way prevent the community from achieving higher water use reductions through developing and implementing more sophisticated, or more restrictive, mandatory conservation measures. Building the LOWWP, which is essentially collecting and treating wastewater at a central point, will provide the community a number of options for further treatment and reuse. The community can then develop these effluent reuse options in concert with the water purveyors and possible agricultural participants.* (Emphasis added.) (See Cited Document 29, p. 3-3.)

The above Response shows the County's basic strategy for avoiding responsibility for mitigation throughout the process. At the time of this response, the project provided even less mitigation for groundwater impacts than it does now. The project sent most of the treated effluent outside the basin to spray fields, with only Broderson disposal (448 AFY) and 160 AFY of conservation to mitigate for the removal of 1100 AFY septic flows. County officials knew they would have to ignore impacts on ESHA and understate potential impacts on seawater intrusion. Environmental reviews for prior projects had consistently found that all the effluent from the project had to be returned to the urban area to have a chance of mitigating impacts on seawater intrusion and habitat. The proposal to return less than half

of the effluent, while exaggerating project benefits and claiming purveyors and Los Osos citizens are responsible for seawater intrusion, clearly shows the County's attempt avoid responsibility for project mitigation and basin sustainability.

The Draft Recycled Water Management Plan (RWMP) show the County's effort to avoid commitment by handing off responsibility to purveyors. As discussed in Section I.E.2.d., the Draft Recycled Water Management Plan (RWMP) states that the County will "rely heavily" on the ISJ for "…annual (monitoring) reports…baseline assessment, establishing success criteria, and ensuring its objectives are achieved…" (See Cited Document 70, p. 57.) The RWMP also indicates that the County will rely on purveyors and other stakeholders for adaptive measures to address seawater intrusion. The RWMP further states the County will use the ISJ "Basin Plan" to meet legal requirements for a basin groundwater manage plan. (See Cited Document 70, p. 57 & 82.) Thus, the County is turning over much of the responsibility for seawater intrusion mitigation to the ISJ.

County officials have stated on several occasions the County will not implement a basin-wide ordinance to stop seawater intrusion, and the Draft Recycled Water Management Plan appears to confirm. The Plan indicates the County will use the ISJ "Basin Plan" to meet the "intent" of AB 3030 (1992) and SB 1938 (2002). (See Cited Document 70, p. 58.) These bills require agencies with jurisdiction over water basins to develop management plan plans with specific objectives, in order to receive funding for water projects from the DWR. Because the ISJ "Basin Plan" will be used to meet requirements for AB 3030 and SB 1938, the "Basin Plan" will also be used as the basis for groundwater ordinance, if the County implements one. The ISJ "Basin Plan," however, will not set specific objectives requiring purveyors and the County to meet specific timelines or performance criteria for seawater mitigation. Further, the plan is not likely to be completed any time soon. The plan and ordinance will not apply basin-wide because purveyors pump only one-half to two-thirds of the water in the basin.

The "Interlocutory Stipulated Judgment" (ISJ) agreement "Preliminary Findings" defines the County's role in the ISJ by citing AB 2701 [Government Code Section 25825.5 (c)];

> *The [County] may undertake any efforts necessary to construct and operate a community wastewater collection and treatment system to meet the wastewater collection and treatment needs within [LOCSD]. These efforts may include programs and projects for recharging aquifers, preventing saltwater intrusion, and managing groundwater resources to the extent that they are related to the construction and operation of the community wastewater collection and treatment system. These efforts shall include any services that the [County] deems necessary, including but not be limited to, any planning, design, engineering, financial analysis, pursuit of grants to mitigate affordability issues, administrative support, project management, and environmental review and compliance services. The [County] shall not exercise any powers authorized by this section outside [LOCSD].* (Emphasis added) (See Cited Document 48, pp. 1 & 2.)

The ISJ agreement also enables the County to adopt a basin wide groundwater ordinance, without concurrence of purveyors if necessary:

> *V.B. The other Parties (purveyors) agree the ISJ shall not preclude the County from adopting and enforcing a groundwater management ordinance with respect to the area overlying the Basin, to the extent that such ordinance is consistent with the BMP. To the extent such County ordinance may be inconsistent with the BMP, the other parties retain the ability to object to the ordinance by all applicable methods. Prior to adopting an ordinance, the County shall consult the other Parties, with consultation to include the measures described in Section V. A. above. (Section V.A.: …such consultation shall, at a minimum, consist of reasonable advance notice by the County of any such proposed actions; reasonable consideration by the County of the viewpoint of the other Parties with respect to any such proposed actions; and a reasonable opportunity for the other Parties to provide comments, objections and suggested alternative courses of action to the County prior to final action by the County."* (Emphasis added) (See Cited Document 48, p. 8.)

As the above information shows, the ISJ agreement does not limit the County's authority to mitigate for the project and implement a groundwater ordinance to manage the basin and stop seawater intrusion. Only the County can limit the County's authority. The County could adopt an ordinance that requires ISJ members to adjust pumping to stop seawater intrusion and ensure mitigation of the project. On the other hand, the agreement does not require ISJ members to mitigate for project impacts, so an ordinance is necessary to ensure measures are enforceable. Purveyors will not agree to an ordinance with specific, measurable, and enforceable outcomes. Golden State Water Company's first commitment is to shareholders and profits (in the case of Golden State Water Company) and covering expenses in the case of the LOCSD and S&T mutual water company. Further, they know the LOWWP has substantial unmitigated impacts that could adversely impact seawater intrusion (See Section I.E.2.e.). Therefore, they will not commit to specific outcomes.

Additionally, the County has asserted in the EIR and other documents that its powers are limited, and only extend to project mitigation. Further, the County has downplayed potential project impacts on seawater intrusion. Therefore, purveyors may claim the County is exceeding its authority by enacting an ordinance to control seawater intrusion. Nonetheless, the ISJ agreement does not limit the County's authority to manage the resource and stop the urgent problem. In fact, the County is not obligated to remain in the ISJ agreement. It can drop out without penalty at any time, just as any other member can. (See Cited Document 48, pp. 1-13.)

Therefore, the County--possibly in cooperation with the LOCSD--could develop an ordinance to stop seawater intrusion outside of the ISJ process. The California Department of Water Resources (DWR) provides a template for a groundwater ordinance to protect threatened water supplies, also indicating that Flood Control and Conservation Districts have authority to implement such ordinances. (See Cited

Document 96.) Rather than claim the right to implement an ordinance that sets enforceable objectives, the County is choosing to rely on the ISJ process, which will not require specific outcomes. As discussed in Section I.E.3.g, purveyors and the County initiated the ISJ in August of 2008, and a draft "Basin Plan" was due out in December 2009. The Basin Update indicated the Basin Plan would be released in December of 2010--but the draft plan is still not out. The CCRWQCB ISJ Update (December 9, 2011) indicates no plan is in sight. (See Cited Document 46, p. 2.) Thus, the ISJ process cannot be counted on to stop seawater intrusion.

The ISJ provides a way for the County to avoid responsibility for seawater intrusion, while supporting growth in the area. Not only will the ISJ fail to produce measurable and enforceable objectives for stopping seawater intrusion (assuming a "Basin Plan" is completed), purveyors will not likely support further conservation although it is the most effective means of stopping and reversing seawater intrusion. The importance of conservation to resolving the problem in the short and long term is confirmed by Eugene Yates, who points out that it is needed to address the fundamental reason for seawater intrusion—basin imbalance. (See Cited Document 35, pp. 1 & 2.) Purveyors have not supported conservation in the past, and with the large water use reduction in the past few years, they are not likely to support further reductions. They are also not likely to take over the recycled water program. (See Sections I.E.2.d.ii. and IE.2.iii. for further discussion on the recycled water program.)

The recent CCWQCB ISJ Update indicates a cooperative nitrate treatment facility will only "…be described at the programmatic level…" because "…the conceptualized nitrate facility has not been funded or designed." A shared nitrate treatment facility and related blending and intertie facilities are needed for major shifts in pumping to the upper aquifer. They are also needed to mitigate for project impacts. Eugene Yates pointed out in June of 2010 that major shifts in pumping were needed immediately to prevent further destruction of the basin, and the 2009 Urban Yield tech memos stats that major shifts were needed for basin sustainability, yet the recent CCRWQCB ISJ Update reports that individual purveyors are pursuing limited measures while the cooperative efforts have been put on hold. (See Cited Document 35, pp. 1 & 2, Cited Document 74, e.g., pp. 6 & 19, and Cited Document 46, pp. 2 & 3.).

The ISJ "Basin Plan" will likely claim that purveyors can continue to pump from lower aquifers and there is enough water in the basin for build out despite continuing seawater intrusion. The CCWQCB ISJ Update indicates the ISJ Working Group has sponsored studies showing the "…seawater intrusion wedge in the upper zone of the lower aquifer (Zone D) will recede in a westerly direction…" "If the estimated safe pumping yield is maintained…" (See Cited Document 46, p. 3.) The Working Group has not released the report to the public—or the Commission. Nonetheless, County officials (e.g., Supervisor Gibson) have told members of the public, including local realtors that the basin has ample water supplies to support build out. County officials are making these claims although conservation has reduced pumping by about 30% (800 AFY) since 2004 and seawater intrusion continues to advance through the large lower aquifer. (See Section I.E.2.l, Table 1.) Basing growth decisions on

modeling, rather than hard evidence (well tests) that show seawater intrusion has stopped and is retreating, continues a long tradition of promoting growth at the expense of the resource. (See Section I.E.3.g for further discussion on the ISJ process.)

In about 1994, purveyors (including the County as operator of CSA 9 until 1998) sponsored studies showing they could continue to pump from the lower aquifers after a 1992 Resource Capacity Study (RCS) concluded that serious overdraft was occurring and seawater intrusion was most likely advancing. The RSC recommended seawater intrusion monitoring, changes in pumping patterns, and comprehensive conservation (See Cited Document 103, pp. 1 & 2.) Responding to complaints from developers, the Board of Supervisors set a Level II of Severity for resource deficiency and a Level III system deficiency (a need to change pumping locations/practices). Because the 1994 study raised the basin yield estimate, no significant action was taken, and the Board failed to require even CSA 9 to move wells and implement conservation. Meanwhile the County continued to allow building outside the prohibition zone and to approve permits for large homes to replace small tear downs within the prohibition zone (just as it does today) resulting in further over draft of the basin.

Further, he County did not implement seawater intrusion monitoring, and it wasn't until 2005 that the LOCSD (established in 1998) sponsored a Seawater intrusion Assessment. The study revealed that seawater intrusion had been advancing since 1985 and had permanently destroyed much of large lower aquifers. In response, the Board of Supervisors implemented a Level of Severity III for resource deficiency, including a "moratorium." The County also enacted an ordinance that allowed building to continue if applicants retrofit low-flow fixtures offsite. The County did not implement basin wide measures or use its ordinance/enforcement authority to stop the overdraft of the basin.

Thus, the County has allowed building to continue despite evidence of advancing seawater intrusion and knowing the basin is being over drafted. Neglect of seawater intrusion and the promotion of development at the expense of the resource continue a history of failing to manage the resource dating back to 1973, when the Department of Water Resources concluded that there was an urgent need for comprehensive management. (See Cited Document 109, p. 46.) In 1974, the CCRWQCB lifted a septic system prohibition for the area on the condition the County would monitor nitrates and implement a septic system maintenance district. However, the County failed to follow through. (See Cited Document 22, p. 1.) Supporting documents for Resolution 83-13 make it clear that one important reason the CCRWQCB banned septic systems is that the County failed to follow through. (See Cited Document 19, pp. 000452 & 000460.)

In the mid 1990's a technical advisory committee (TAC) was formed to develop a wastewater solution for Los Osos. The TAC arrived at a plan for a basin-wide septic system management program, with collection and treatment for areas with high groundwater. On the day the plan was supposed to be approved, Bud Laurent, district supervisor at that time, suddenly decided a community-wide sewer was a better solution, saying he had had an "epiphany" the night before. While the CCRWQCB might

have had something to do with the sudden change of direction, at least one public commenter at the meeting (a developer living outside the prohibition zone) threatened to sue if the Board approved the septic management program.

It is likely people living outside the prohibition zone on larger properties (in higher income areas than the prohibition zone) have exerted influence on the process. This is supported by the fact that the only written comment the County submitted (other than responses to the Water Boards in 1983) regarding Resolution 83-13 was a request to exclude Cabrillo Estates from the prohibition zone, and the only written comment the County submitted in 2011 regarding the WDR for the LOWWP was that the County should not be required to implement a septic management program for homes outside the prohibition zone. The CCRWQCB's response reminded the County that it does have responsibility for septic management and a draft plan is on file that was never implemented (See Cited Document 23, p. 11.)

As evidenced by high levels of conservation recently, the potential for stopping seawater intrusion and averting the seawater intrusion crisis existed had the County taken steps in the 1970s, 80's, or 1990's to implement comprehensive conservation. Further, had the County pursued seawater intrusion monitoring and used its authority to require pumping changes, the seawater intrusion crisis could have been avoided. Finally, had the County established a septic management program in the 1970's or 80's and implemented nitrate management in cooperation with the CCRWQCB, the nitrates issue would have been avoided.

Now that seawater intrusion is threatening the resource, the County (CCRWQCB and SWRCB) are denying they have any authority or responsibility to address the issue, insisting that purveyors are responsible and the ISJ Basin Plan will solve the problem. County and CCRWQCB officials have even claimed the community is to blame for seawater intrusion by failing to approve a wastewater project (i.e., contamination of the upper aquifer has led to over pumping the lower.) However, evidence supports that neither seawater intrusion nor elevated nitrates would be problems today had the County and CCRWQCB taken reasonable actions to manage the basin.

<u>The County has also shown a lack of commitment to mitigate and failure to disclose information by burying the public and reviewing agencies in a mountain of review materials that repeat inaccurate, erroneous, or incomplete information.</u> The County's tactic throughout the project development process has been to stick by flawed findings in the EIR, repeat the same inaccurate and incomplete information, and to bury the public and decision makers in a mountain of documents that repeat the same inaccurate or incomplete information. County officials have repeated, for instance, that Broderson leach fields are sure to work, the project is essential for basin sustainability and the LOWWP is the least-harmful feasible alternative--despite considerable substantial evidence to the contrary.

This tactic of "changing minds, not the project" is best shown in a statement of Supervisor Gibson's at a Los Osos Community Advisory Council (LOCAC) meeting in July of 2009. He made the statement in response to a letter the County had recently received from Dan Carl, District Manager of the Santa Cruz Coastal Commission Office. In the letter, among other concerns, Mr. Carl states that the project should do more to address seawater intrusion (See Cited Document 2, p. 2.) Supervisor Gibson responds to the public's questions about the letter with the following:

> *As to the letter from the Coastal Commission, which is really the only other thing that I heard looking for a response on, Paavo indicated he was very pleased to have that letter come forward at this time. It lays out a lot of issues that need to be addressed before the project is complete. I would only observe, on a couple of notes, that, first of all, that letter is from Coastal Commission staff, and it's not from the Coastal Commission. So that's an important issue, because it's going to be the commissioners themselves that are going to make the determinations on the project when it comes before them. As we look through that letter, this is a staff out of the Santa Cruz office that is extraordinarily strapped for time; they're stretched very, very thin. And in reading the letter, you'll see certain conclusionary statements that they make, and so far as we can tell, they're not very well informed on the actual technical issues behind the issues. And the other aspect of that is that we continue to work with staff. They just have not had time to look into this in any great amount of detail. These are concerns that we have talked to them at some other times. Paavo will be talking to staff to staff project team to the Coastal Commission. My sense - well, it's clear that these issues are going to have to be resolved. And there are basically two ways of resolving them - one is to change the project and the other is to change the minds of Coastal Commission staff. And my estimation is that there's going to be more changing of the mind of the Coastal Commission staff than there is actually going to be changes to the project involved. We continue to monitor that, and we will look forward to the conclusion of the Planning Commission hearings.* (Emphasis added) (See Cited Document 104.)

This County employed this tactic of "changing minds, not the project" through the Coastal Commission review process in June of 2010. When Commission Staff requested information to address the substantial issues related to groundwater, the County sent 894 pages, mostly copied from the 2000-3000-page EIR that ignored impacts and overstated project benefits, even going beyond claims in the EIR. (See Section I.E.2.a.iii.)

This led to the Commission's approval of the project with severe unmitigated impacts. Condition 5 fails to make groundwater mitigations any more specific, measurable, or enforceable--which is the reason the Commission found substantial issue. Instead, the Commission attempted to address even more serious potential adverse impacts primarily with monitoring and adaptive management, essentially deferring mitigation. (Impacts had become more serious because the prior month

seawater intrusion was found to be moving 12 times faster than the EIR assumed.) Despite even more serious impacts, County officials convinced Commission Staff that adaptive management would be enough—continuing to falsely claim the project was urgently needed for public health and safety, while pressuring the Commission to expedite approval of the project to meet a funding deadline.

Another way the County showed a lack of commitment to mitigation was by hiring most local consultants with prior experience on Los Osos wastewater projects to keep them from weighing in against the project. Mark Hutchinson, County Environmental Coordinator, acknowledged this strategy to an LOSG member early in the process, and we believe the record shows almost all local consultants having prior experience with a Los Osos wastewater project were hired to consult on the LOWWP. As the LOSG has indicated, we have been virtually alone in the effort to point out impacts to wetlands, creeks, and the estuary. Dr. Don Asquith, a consultant who originally worked for the Morro Group, the firm that wrote the EIR for a County project in the late 1990's is currently working for the ISJ Working Group as a consultant. He was, we believe, the first consultant to suggest the current Broderson disposal site, and also the author of the Condition 20 monitoring and mitigation plan for the prior project. One of our members recalls that he made a public comment at a local meeting shortly after release of the LOWWP DEIR, stating that Broderson disposal was not as certain to work as the EIR made it sound. (We did not have time to locate and provide a recording of this meeting).

The above information shows that the County has been intent from the start of project development to ignore impacts, preclude relevant information, and bury the public and decision makers in voluminous documents that repeat inaccurate, erroneous, or incomplete information—as part of an overall strategy to change the minds of the public and reviewing officials, rather than change the project. This provides substantial evidence the County is not committed to project mitigation or basin sustainability, and it provides an important reason to grant this Request for Revocation to protect and preserve coastal resources.

I.E.2.i.ii **The CCRWQCB has shown a failure to commit to project mitigation and basin sustainability.** As a "responsible agency" under CEQA, the CCRWQCB must comply with CEQA requirements in the review and approval of a Waste Discharge Requirement (WDR). The CCRWQCB is also one of the two regulatory agencies requiring the project (and has initiated enforcement actions and levied fines to have a project constructed), and the CCRWQCB is the primary agency responsible for regulating and protecting water quality (including water quality degraded by seawater intrusion). In addition to the CCRWQCB's failure to provide accurate and complete information, the failure of the agency to commit to project mitigation and basin sustainability is an important reason for denial of the project CDP.

The CCRWQCB has failed to commit to project mitigation and basin sustainability in four ways: 1) by providing inaccurate, erroneous, and incomplete information that withheld severe unmitigated impacts and overstated the benefits of the project, 2) by failing to comply with CEQA requirements in its review of the project, 3) by failing to pursue and implement basin management initiatives,

programs, and policies that would address seawater intrusion, and 4) by denying and/or failing to pursue any wastewater management options other than a centralized wastewater project since 1983. The failure of the CCRWQCB to commit to project mitigation continues a long history of neglect and mismanagement of the basin in its effort to implement Resolution 83-13. It has pursued this narrow solution, to the exclusion of other alternatives, even though science, technology, and basin conditions no longer support the Resolution or a centralized project. (See Section I.E.3.a. for further discussion of Resolution 83-13.)

The CCRWQCB has failed to commit to project mitigation and basin sustainability by providing inaccurate, erroneous, and incomplete information that withheld severe unmitigated impacts and overstated the benefits of the project. The evidence we provide in this Request shows that the CCRWQCB intentionally withheld severe potential adverse impacts on the water supply, ESHA, and public health and safety. (See Sections I.E.2. and I.E.2.f.i.) The CCRWQCB also substantially overstated the benefits of project. (See Sections I.C. I.D. and I.E.1.) Unmitigated adverse impacts include severe earthquake, cumulative, and socio-economic impacts that substantially increase other impacts and could result in catastrophic consequences for the area. (See Sections I.E.2.e. and I.E.2.f.i.) Overall, the CCRWQCB has withheld information showing the project will do much more harm than good to resources (See Part II.)

The CCRWQCB has further shown a lack of commitment by failing comply with CEQA and other laws and regulations.

In failing to disclose and mitigate impacts during the project review process, the CCRWQCB violated Coastal Commission Administrative Regulations, the Coastal Act, CEQA, NEPA, and other laws and regulations, which require agencies to address all significant adverse impacts, to identify the least-harmful feasible options/alternatives, to base decisions on substantial evidence in the record, and/or to provide accurate, complete, and relevant information as soon as possible to other agencies and the public.

The CCRWQCB asserts in the WDR that the EIR did not identify any adverse impacts within the jurisdiction of the CCRWQCB, and that, as a "responsible agency" under CEQA, the CCRWQCB independently reviewed the LOWWP EIR, coming up with to its own conclusions "…on whether and how to approve the waste discharge requirements for the project pursuant to CEQA (CEQA Guidelines Section 15096)" (See Cited Document 11, p. 9.) The WDR states:

> *As the lead agency, the County certified a final Environmental Impact Report (EIR) on September 29, 2009, for the construction and operation of a sewage treatment and water recycling facility. The EIR did not identify any potentially significant environmental effects with respect to the adoption of these waste discharge requirements and within the jurisdiction of the Central Coast Water Board. Specifically, the EIR identifies no impacts with respect to groundwater quality and water supply (EIR Table Q.2-1, Section 5.2) and no*

impacts with respect to drainage and surface water quality (EIR, Table Q.2-1, Section 5.3). The EIR explained that the County would need to obtain a Clean Water Act Section 404 permit and a Clean Water Act Section 401 (Water Quality Certification) for potential adverse effects on federally protected wetlands. The Central Coast Water Board will consider water quality certification in a separate regulatory process, which is not subject to the requirements of this Order…

…Since the EIR has not identified any potentially significant environmental effects within the Water Board's jurisdiction, the Water Board is not required to make any specific finding pursuant to CEQA Guidelines 15096. The proposed waste discharge requirements will result in improved water quality in the Los Osos Basin since they require advanced tertiary treatment that will remove nitrates, among other constituents, to concentrations below applicable water quality objectives, and because discharges from individual onsite systems that have polluted groundwater and contaminated surface water will cease upon completion and operation of the facility. (Emphasis added) (See RWQCB WDR, pp. 9 & 10.)

The CCRWQCB claims that, after reviewing the EIR, it did not identify any "environmental effects within the Water Board's jurisdiction," further asserting that its review is limited to consideration of whether the project will eliminate septic systems and reduce nitrates. However, the CCRWQCB is also responsible for determining if the project could have adverse impacts on seawater intrusion and habitat, whether it could cause aquifer degradation by salt build up from the recycled water program, and whether mitigation measures are feasible. The CCRWQCB is also required to determine whether the project will do more good than harm, and whether a less harmful feasible alternative is available--and it must independently verify the accuracy of the EIR. Evidence clearly shows the CCRWQCB did not meet its obligations under CEQA.

For instance, the WDR did not address unmitigated impacts from the high salt content in the recycled water, the potential for the program to be underused due high salts, or the feasibility of additional mitigation measures. (See Sections I.E.2.d.ii, and I.E.2.e.ii.) The CCRWQCB also did not address the potential for Broderson leach fields to cause liquefaction under homes, or the feasibility of disposal/mitigation options. (See Sections I.E.2.c.iv. and I.E.2.f.) Roger Briggs, the Executive Director of the CCRWQCB, pointed out these potential adverse impacts in his DEIR comments, but did not raise them in the review of the project for the WDR. (See Cited Document 5, pp. 3-5 and Section I.E.2.d.ii.) The CCRWQCB also failed to address the adverse impacts to habitat from reduced groundwater flows, and the adverse impacts on wells that tap the shallow aquifer (although improving the beneficial use of the shallow aquifer is a main goal of Resolution 83-13). (See Section I.E.2.c.i.) Further, the CCRWQCB did not mention the need for a feasibility study for the recycled water program, required by the SWRCB for grant funding. (See Section I.E.2.d.ii.) These are just some of the potential adverse impacts the WDR failed to address. Clearly, the CCRWCB failed to mitigate for the project.

[See Angel Law comment on the WDR submitted to the CCRWQCB on behalf of Citizens for a Sustainable Community (CSC) (See Cited Document 49.) Also see LOSG appeal of the WDR to the SWRCB. (See Cited Document 25.)

The CCRWQCB also failed to commit to project mitigation and basin sustainability by failing to pursue and implement basin management initiatives, programs, and policies that would address seawater intrusion.

The LOSG submitted a request to the CCRWQCB in May of 2010 for the Board to take immediate action to "stop the degradation of the water supply in the Los Osos Valley Basin" from seawater intrusion. (See Cited Document 105.) We requested, among other actions, for the Board to implement water quality objectives for chlorides and an action plan to stop degradation of the water supply by seawater intrusion. We further requested that the Board "Coordinate resource protection agencies and other stakeholders to address seawater intrusion as part of a Watershed Management Plan for the basin, similar to the plan it coordinated for the Salinas River Watershed. The Salinas River plan states that seawater intrusion is a non-point source of pollution under the CCRWQCB's jurisdiction. (See Cited Document 106.) The CCRWQCB set chloride objectives for the Salinas River Watershed and added the objectives to the Regional Basin Plan. The LOSG also requested that the CCRWQCB support a basin-wide management plan and an ordinance, with specific objectives for stopping seawater intrusion, consistent with LCP Watershed Policy 5.

The CCRWQCB took no action in response to our request (other than to provide ISJ updates from time to time) stating the Board can do nothing to address seawater intrusion and claiming. The Board claimed—as the County claims—that seawater intrusion mitigation is the responsibility of water purveyors. Obviously, the CCRWQCB can do more to address seawater intrusion—and it could have done more in the past. All studies of the basin since the 1970s have warned of the serious threat seawater intrusion poses to the basin, especially with removal of septic systems, yet the CCRWQCB has remained focused only on reducing elevated nitrates in the upper aquifer with a centralized wastewater project per Resolution 83-13. (See Cited Document 109, pp. 43 and 45.) Also see Section I.E.3.a. for further discussion of Resolution 83-13.)

In 1995 the CCRWQCB approved the San Lorenzo River Watershed Management Plan, which had been effective since the mid 1980's, and in the 1998 the CCRWQCB approved the Salinas Watershed plan. A similar plan in Los Osos would likely have avoided the seawater intrusion crisis and reduced elevated nitrates (i.e., met project objectives). (See Section I.E.1.d.iii.)

The CCRWQCB has failed to commit to project mitigation and basin sustainability by denying and/or failing to pursue any wastewater/management options for 30 years, other than a centralized wastewater project as prescribed by Resolution 83-13.

Since 1983, CCRWQCB has failed to consider or allow alternatives to a centralized wastewater project in the prohibition zone. As discussed in Section I.E.2.i.ii above, a technical advisory group proposed a basin-wide septic system management plan with collection and treatment for high groundwater areas in 1995, and in the late 1990s, the "Solutions Group" developed a similar plan. About the same time the County Board of Supervisors added Watershed Policy 5 to the LCP, calling for the County to coordinated with the CCRWQCB to "…implement a basin-wide water management program for the Los Osos groundwater basin…," that addressed groundwater quality and other issues. (See Cited Document 80.)

The Community voted to establish a community services district in 1998, largely on the basis that the Solutions Group project provided a preferable alternative to a County-proposed project, which sewered the prohibition zone and did not provide basin-wide wastewater management. The community showed its support for the "Solutions Group" plan, which included ponding treatment at the Tri-W site, by approving an assessment to purchase land and move the project forward. However, the CCRWQCB rejected the plan because it was not consistent with Resolution 83-13. The Coastal Commission also reviewed the plan and, after finding it to be feasible, recommended against it because the project did not comply with Resolution 83-13. (See Cited Document 107, pp. 3 and 15.) The LOCSD then modified the design to meet the CCRWQCB demands. The resulting project required a reverse osmosis treatment facility to be housed in a large concrete structure at the Tri-W site. The projects central location, escalating costs, high energy demand, and frequent sludge hauling were also factors that turned the community against the project, ultimately resulting in a recall of the LOCSD Board of Directors, but not until after the Board members authorized construction to start.

The new LOCSD directors put a stop on construction, but did not terminate construction contracts. They had campaigned primarily on a "move the sewer" platform, so they were willing to implement the funded project if the treatment site was moved out of town. Samuel Blakeslee (a State Assembly member at the time, now a State Senator) facilitated negotiations between the LOCSD and State and Regional Water Boards. The LOCSD and Water Boards negotiated a plan, but the SWRCB later rejected it. Reasons are not clear but evidence supports that the SWRCB did not believe it could recoup the approximately $6 million of an SRF loan awarded with the previous project. The SWRCB had not required Proposition 218 assessments to secure the loan. The SWRCB then pulled the loan and sued the LOCSD for the $6 million, the CCRWQCB levied fines against the LOCSD for about $6 million, contractors filed suit, and LOCSD was forced into bankruptcy. Assemblyman Blakeslee then sponsored AB 2701, which turned authority for wastewater project over to the County. Later the CCRWQCB initiated enforcement actions (cease and desist orders—CDOs) against 40 families for "illegal" discharges. The families appealed the actions, filed suit, and recently appealed a Superior Court decision upholding the CCRWQCB actions. (See Section I.E.3.c. for further discussion.)

The community has attempted twice to implement a comprehensive septic system management plan, with collection and treatment of low lying areas, but efforts have been thwarted by County and/or

CCRWQCB. Evidence shows the community has done its part to remedy its wastewater issues. As discussed in Section I.E.3.a., Resolution 83-13, the CCRWQCB order to eliminated septic systems, is obsolete but continues to drive the process. The critical seawater intrusion problem, stabilized nitrates, proof that septic systems are not harming the estuary, purveyor plans to use nitrate treatment for the upper aquifer, the potential for a severe earthquake, and growing concerns over climate change, GHG emissions, and sea level rise—all support the need for a comprehensive management solution for the area—at 1/10th the cost with none of the risk.

This conclusion is further supported by the fact the County, CCRWQCB, and SWRCB are refusing to commit to project mitigation and basin sustainability. No agency is taking responsibility for the project or the basin. It is no wonder--agencies know the project will likely do more harm than good to the basin and sensitive habitat—and it could have catastrophic consequences.

I.E.2.j. Table A: Unmitigated Groundwater Impacts

(from the elimination of septic system flows/recharge Including why conditions/programs do not mitigate for impacts)

Impacts	Measure/Condition	Why conditions/programs do not mitigate impacts
Adverse impacts on ESHA: wetlands, marshes, springs along the estuary, also Willow Creek, Eto Lake, and Los Osos Creek. (Although the DEIR states the LOWWP will not impact ESHA, the groundwater monitoring and management plan for the prior project (CDP Condition 20) identified significant potential impacts to virtually all aquatic ESHA in the area.)	**Special Condition 5c,d and Condition 87** Groundwater Monitoring and Management Program (Adaptive management measures to be developed are supposed to replace flows and allow adjustments in pumping to respond to signs of seawater intrusion.)	***Not feasible*.** The prior Los Osos Wastewater provided multiple, dispersed leach fields with harvest wells as the backbone of its adaptive mitigation program for both sensitive habitat and seawater water intrusion (This combination maintained groundwater flows and offset pumping of the lower aquifer.) However, multiple leach fields and harvest wells are not feasible for the LOWWP, in part because harvest wells are prohibited. (See I.E.2. c.iii. and I.E.2.c.iv.) Also, any adaptive management measures designed to respond to worsening seawater intrusion require purveyors to adjust pumping patterns and practices although purveyors are not likely to be unwilling and/or unable to make the changes (e.g., due to lack of adequate infrastructure). Further, recycled water will be too salty for a viable reuse program,, and there will not be enough water to replace flows to habitat (See I.E.2.b.i.). Use of potable water will be required but not be feasible due to the over drafted basin and seawater intrusion. No specific adaptive management measures have been identified or budgeted (e.g., to restore flows to habitat) and would add to impacts and likely be economically infeasible due to the current very high project costs. (Also see Conditions 97 and 101 below, and Tables 1 & 2 on the next pages.). ***Not effective.*** Determining baseline conditions and specific, measurable, enforceable, and feasible mitigation measures will be impossible due to unstable basin conditions and reliance on purveyors. Adaptive management will also be ineffective due to the timescales involved (20 years or more for some groundwater impacts to occur).
Adverse impacts on ESHA: wetlands, marshes, springs along the estuary, also Willow Creek, Eto Lake, and Los Osos Creek.	**Condition 88** Voluntary Rainwater Recharge Program (Encourages homeowners to use abandoned septic systems in appropriate conditions to convert to rainwater catchment/reuse systems.) (Is supposed to replace flows to ESHA)	***Not effective*.** Repurposing septic systems is a voluntary program that requires specific conditions (e.g., minimum depth to groundwater), so its benefits are not specific, measurable, or enforceable. Further, the measure will not replace groundwater flows eliminated with septic systems; instead, it will provide an alternative way to percolate rainwater that currently percolates on site. Most rainwater falling on properties already percolates to groundwater. Septic system return flows provide additional recharge, but directing rainwater to abandoned systems does not replace this additional recharge. ***Not feasible.*** Site constraints, homeowner resistances, and/or water quality concerns may make program infeasible.

I.E.2.j. Table A (Cont.): Unmitigated Groundwater Impacts

(from the elimination of septic system flows/recharge Including why conditions/programs do not mitigate for impacts)

Impacts	Condition/Program	Why conditions/programs do not mitigate impacts
Adverse impacts to seawater intrusion/ water supply, and on ESHA: wetlands, marshes, springs along the estuary; and Willow Creek, Eto Lake, and Los Osos Creek. **Los Osos Creek and Los Osos Creek Estuary is not identified as potentially impacted.	**Special Condition 5a and Condition 97 the *Recycled Water Program with Broderson leach fields the main mitigation measure.*** (Has Broderson leach fields as the main groundwater mitigation measure and states that offsetting seawater intrusion and potable water use are "priorities:"; sets minimums of 10% for ag and habitat conservation uses.)	***Not feasible.*** Broderson liquefaction risks have not been mitigated and it is likely they can not be mitigated, ***Not effective.*** The program provides almost no mitigation for accelerating seawater intrusion in the lower aquifer. Broderson disposal (using two-thirds of the treated effluent, 448 AFY) will not benefit accelerating seawater intrusion 200-400 feet underground with any level of certainty, especially with increased pumping from the upper aquifer. In addition to Broderson disposal, the County Draft Recycled Water Management Plan provides for 33 AFY of disposal at Bayridge Estates leach fields, 160 AFY of agricultural reuse, 42 AFY of urban reuse at schools, and 80-95 AFY of urban reuse at the golf course and cemetery. Of these, only 42 AFY of urban reuse at schools offsets lower aquifer pumping providing direct benefits to seawater intrusion (but only if purveyors reduce pumping in affected areas). Ag reuse provides virtually no benefit because it offsets pumping in a part of the basin not affected by seawater intrusion (east of Los Osos Creek). Broderson recharge of the upper production aquifer will take 20 years (or more). Vertical flows from septic systems will stop supplying groundwater within a few months, but lateral flows from the Broderson site will take 2 to over 20 years to move to affected parts of the basin—and flows from Broderson will never reach some parts of the urban area and estuary fringe in the northern and eastern parts of the community. Moreover, full operation of Broderson will not occur until at least two years after project start up due to testing.
Adverse impacts on seawater intrusion/ water supply	**Special Condition 5b and Condition 99** Conservation Program (Targets 50 gpcd, implemented with $5 million.) (Is supposed to mitigate for seawater by offsetting pumping)	***Not effective.*** 800 AFY of conservation has occurred in the urban area since 2004, using up most, if not all, of the potential for conservation to mitigate for seawater intrusion, even as seawater intrusion accelerated. This shows conservation cannot mitigate for project seawater intrusion impacts. Effective mitigation with conservation also requires purveyors to be willing and able to shift pumping as needed, but they don't have the infrastructure or agreements in place to do so.
Adverse impacts on ESHA--Willow Creek Drainage, etc.	**Condition 101** Bayridge Estates Leach Field Disposal (33 AFY of recycled water (Is supposed to replace groundwater flows.)	***Not effective.*** Bayridge Estates disposal at most will provide 33 AFY of flows to Willow Creek Drainage, even though the current flows from septic systems to the area are at least 250 AFY. (See Table 2 attached.). Thus, Bayridge Estates disposal does not effectively mitigate impacts on the sensitive habitat.

I.E.2.j Table A: Unmitigated Groundwater Impacts

(from the elimination of septic system flows/recharge Including why conditions/programs do not mitigate for impacts)

Impacts	Condition/Program	Why conditions/programs do not mitigate for impacts
Adverse impacts on seawater intrusion/water supply	**Condition 103** Toilet-Faucet Retrofit (Requirement to retrofit toilets prior to hook up to the project.)	(Same as Condition 99)
Adverse impacts on seawater intrusion/water supply	**Condition 108** Installation of meters in the S&T water district.	(Same as Condition 99)
Adverse impacts on seawater intrusion/water supply and ESHA with recycled water, conservation, monitoring, and adaptive management programs. (In some cases, incorporates and expands Conditions 87, 88, 97, 99, 101, 103, and 108.) with the "objective" … *to ensure that implementation of the project, including the sites designated for disposal of the treated effluent, is accomplished in a manner designed to maximize long-term ground and surface water and related resource (including wetlands, streams, creeks, lakes, riparian corridors, marshes, etc.) health and sustainability, including with respect to offsetting seawater intrusion as much as possible, within the Los Osos Groundwater Basin*.	**Special Condition 5** ***The Los Osos Basin Recycled Water Management Plan***	Does not provide specific, measurable, enforceable mitigation measures or performance/success criteria. Does not require baseline assessments and set success criteria until after project approval (Assessments prior to approval were needed to determine the feasibility of measures and they would have shown feasible measures do not exist.) Does not ensure mitigation for habitat (e.g., adequate recycled water). Does not ensure mitigation of impacts on seawater intrusion in the upper aquifer or lower aquifers. Conditions 87, 97 and 99 do not provide adequate recharge, pumping offset, redundancy to back up Broderson and avoid/minimize impacts. Does not ensure mitigation if monitoring reveals harm to habitat or the basin. Specific measures (e.g., in the Draft Recycled Water Management Plan) have not been identified nor funding allocated.

I.E.2.j. Table B: Other Unmitigated Impacts

Earthquake, Air Quality/GHG, Cumulative, and Socio-Economic

Impacts	Condition/Program	Why conditions/programs do not mitigate
Adverse impacts from liquefaction to public health and safety (including injury and death), severe property damage, infrastructure damage, and harm to ESHA from earthquakes (e.g., collapse of structures, system shut down, overflows, and back ups). (No impacts identified for Broderson leach fields although EIR indicates liquefaction will occur due to lateral flows of water in Horizon A during disposal)	**Geotechnical report for collection systems** (None for Broderson leach fields)	A geotechnical report does not mitigate for impacts. Severe damage to systems and total shut down occurred with the Fukishima, Japan and Christ Church, New Zealand earthquakes-- manholes were floated/forced up through streets.
Adverse indirect and cumulative impacts from the ISJ Water Management Plan on seawater intrusion/ water supply, and ESHA: wetlands, marshes, springs along the estuary; and Willow Creek, Eto Lake, and Los Osos Creek. (No impacts identified.)	No mitigation	Adverse impacts on the upper aquifer from the combined effects of major shifts in pumping and reduced flows with the project were not addressed, nor were cumulative effects of pumping shifts inland on wells, aquifers, and habitat. Also, the project's indirect adverse impacts on seawater in the lower aquifer were not identified or addressed. These will result from delays in purveyor actions needed to stop seawater intrusion, including shifts in pumping and cooperative nitrate treatment agreements. Purveyors are aware of potential adverse project impacts on the aquifers and will avoid investments that may not be cost-effective although the measures are needed for basin sustainability.
Adverse indirect and cumulative impacts from the Recycled Water Management Plan on seawater intrusion/ water supply, soils, and ESHA: wetlands, marshes, springs along the estuary; and Willow Creek, Eto Lake, and Los Osos Creek. (No impacts identified)	No mitigation	Adverse impacts on the aquifers, habitat, and soils from the high salt-content of recycled water and contaminants have not been addressed, nor were the indirect effects of low participation in the program, including adverse impacts on seawater intrusion and aquifers from inadequate return of recycled water (recharge) and pumping offsets. Other indirect and cumulative impacts include impacts from additional facilities to store or dispose of recycled water due to under use of the program and the use of potable water for habitat restoration causing further adverse impacts on seawater intrusion.
Adverse socio-economic impacts, including cumulative impacts from the high cost of the sewer, in combination with water rate increases, and costs for unmitigated impacts on seawater intrusion/ water supply, soils, and ESHA: wetlands, marshes, springs along the estuary; and Willow Creek, Eto Lake, and Los Osos Creek. (No impacts identified.)	No mitigation	The very high cost of the project ($150 to $350 per month or more per property owner), in combination with rising water costs and the cost of unmitigated project impacts will cause will prevent/delay essential water-quality and water supply programs, including purveyor shifts to the upper aquifer and nitrate treatment, also a needed storm water management program. It will also prevent or delay adaptive mitigation measures needed to avoid/minimize impacts to the aquifers and ESHA. Because the project could further destabilize and destroy the basin as the area's sole source of water, the project could have catastrophic effects since alternatives are not feasible.

(See II.D.1. for a more complete list of adverse impacts including growth-inducement impacts.)

I.E.2.j Table 1: Conservative Estimate of LOWWP Adverse Impacts on the Upper Aquifer with Purveyor Shifts in Pumping by 2015

Conditions/Water Use	Total	Purveyor	Private	Purv.Upper	Purv. Lower	Up. Aq. Loss
2008 EIR Water Use (from 2004) (Cited Document 38, Table 8, p. 24 & C of D-2, Balance Sheet)	2500	2300	200[7]	600	1700	0[6]
***ISJ Urban Yld TM, 7/*2009** (based on yield estimates, Cited Document 74, p. 6 and Balance Sheet)	2200	2000	200[7]	600	1400	-100 [6]
Current 1/2012 (Estimated from LOCSD Utility's Dept. water use logs) [9]	1900	1700	200[7]	500[7]	1200[7]	-100[6]
LOWWP 2015 w/conservation. & shifts to upper aq [1]	**1600**	**1400**	**200[7]**	**900**	**500**	**-400****
Project reduction to upper aquifer (-400 AFY)[2]						-800
Broderson disposal (+450) [3]						-350
Net loss with reuse offset (+50 AFY)[4]						-300
Net loss with Broderson delay/failure[5]						-750**

[1] Assumes very aggressive conservation (600 AFY of reduction by 2015 over 2009 water use, rather than the 450 AFY assumed in Scenario E (the most aggressive scenario of the ISJ/County draft conservation plan). (See ISJ Dft. Consrv.Pl, p. 11). (Note: The County Draft Recycling Plan selected Scenario D from the ISJ plan but added a provision for high-efficiency washer rebates; therefore, this estimate uses the more aggressive Scenario E water with washer rebates from the ISJ plan.)

[2] Assumes LOWWP eliminates 750 AFY of septic system recharge per the County Recycling Plan with 400 AFY recharging upper aquifer based on Cited Document 38. Table 8, p. 24 and Appendix C of D-2 Balance Sheets. This assumes a higher percentage of flows from septic system recharge to the upper aquifer than assumed in the DEIR; the DEIR fails to account for septic system flows in perched aquifer leakage to upper aquifer, comprising about half of the recharge to that aquifer.

[3] Assumes Broderson disposal recharges the upper aquifer at the rate of 450 AFY from project start up without water loss in any part of the aquifer (i.e., an ideal condition that is not possible). Broderson will not operate at full capacity (450 AFY) initially as it is tested, it will not percolate all water directly to upper aquifer (e.g. because some will saturate Horizon A), and it will not maintain water levels (potentially adversely impacting production wells) due to testing, recharge delays and/or failures.

[4.] Assumes 50 AFY of reuse at Sea Pines Golf Course per the County Draft Recycling Plan (i.e., 30-45 AFY) (See Cited Document 70, p. 5).

[5] Assumes a delay and/or failure for Broderson recharge.

[6.] Assumes a baseline per EIR conditions (approximately 1200 AFY of septic system return flows, with 600 of purveyor pumping and 200 AFY of private pumping from the upper aquifer). Also, assumes that 300 AFY of reduced water use from conservation represents a 200 AFY reduction in indoor use, with one-half (100 AFY) not recharging the upper aquifer, resulting in a 100 AFY deficit. The deficit from 300 of conservation between 2009 and present is offset by a 100 AFY assumed reduction in upper aquifer pumping
(Row 3, Column 5). Assumes 200 AFY of private pumping from the upper aquifer in the urban area based on the 2005 Seawater Intrusion Assessment. (See Cited Document 37, p. 14.) Since no use of the upper aquifer (Zone C) occurs west of Los Osos Creek, 200 AFY of private use is assumed to be from Zone C in the urban part of the basin west of the creek.

[7] Assumes safe yields below the "sustainable yields" (1490 AFY upper aq., 620 AFY for purveyors; 1670 upper, 655 lower total yield) of the 2009 Urban Yield TM, which does not stop seawater intrusion. (See Cited Document 36, p. 6 & Balance Sheet.)

**With septic systems left in place, aggressive conservation would result in a 400 AFY net reduction in water in the upper aquifer. The deficit would be 750 AFY with the LOWWP. Enhanced recharge of the basin via a comprehensive community storm water/LID recharge program would offset the 400 AFY reduction with no the project; whereas, the project (e.g., Condition 88) will not offset project impacts, and the cost of the LOWWP will prevent implementing a comprehensive storm water/LID program.

I.E.2.j Table 2: Conservative Estimate of LOWWP Adverse Impacts on the Perched Aquifer and Shallow Groundwater Flows to ESHA by 2015

Conditions/Water Use	Sep Sys (Zone A)	Water Lvl/Outflw Loss (EIR bsln)	Water Lvl/Outflw Loss (Current bsln)	Sep Sys (Zones A B C)	Water Lvl/Outflw Loss (EIR bsln)	Water Lvl/Outflw Loss (Current bsln)	
	Zone A			Zones A,B,C			LO Creek
EIR, 2008 (Cited Document 38, Table 8, p. 24 & Balance Sheets)	600[1]	0	+200	1200[2]	0	+300	360 AFY[5]
Cited Document 36 (based on yield estimates), Cited Document 74, Page. 6 and Balance Sheet)	500[1]	-100[1]	+100	1050[2]	-150	+150	
Current 1/2012 (Estimated from LOCSD Utility's Dept. water use logs)	400[1]	-200[1]	0	900[2]	-300	0	
2015 with conservation	300[1]	-300[1]	-100	750[2]	-450	-150	150 to 250 AFY [5]
LOWWP 2015 w/o septic systems	0	-600	-300	0	-1200	-750	
LOWWP w/ Broderson disposal (+450) [3]	0	-600[3]	-300[3]	0	-800[3]	-350[3]	
LOWWP w/ Bayridge Estates (+33 AFY)	0	**-567**	**-267[4**]**	0	**-767**	**-317[4**]**	**-150 AFY to -250 AFY[5**]**
LOWWP w/ remainder of recycled water applied (+37 AFY)	0	-530	-230[4]	0	-730	-290[4]	

[1] Assumes 600 AFY of septic system recharge (per Cited Document 38, p. 24 and C of D-2 Balance Sheets) is reduced by 100 AFY for every 300 AFY of conservation, with 200 AFY of the 300 AFY due to indoor conservation, reducing septic system recharge, and half of that (100 AFY) reducing perched aquifer recharge. (A 900 AFY total reduction from conservation is assumed for "2015 with conservation" over EIR conditions, with 600 AFY occurring already (shown in "Current" conditions) and 300 AFY occurring by 2015.

[2] Assumes 1200 AFY of septic system recharge (per Cited Document 38, p. 24 and C of C-2 Balance Sheets) is reduced by 150 AFY for every 300 AFY of conservation. This is 50 AFY/300 AFY less than assumed for the perched aquifer (150/300 AFY vs. 200/300 AFY) to arrive at the 750 AFY of LOWWP initial flows (per the County Draft Recycling Plan) and to reflect the likelihood that conservation will have a greater influence on the perched aquifer (Zone A) than the upper aquifer (Zone C).

[3] Assumes Broderson disposal has no influence on the perched aquifer (per the DEIR) but that Broderson offsets 400 AFY of septic system recharge with the LOWWP (400 AFY is the amount septic systems are assumed to recharge the upper aquifer--see Table 2, previous page).

[4] Assumes boldface estimates are more reasonable than estimates in the last row because the 37 AFY of "remaining recycled water" is not likely to be applied to restore flows to habitat. Determining baselines, setting specific performance objectives, and identifying feasible, measureable, enforceable mechanisms/measures to restore flows will most likely be impossible.

[5] Assumes the same flows from septic systems under EIR conditions (320,000 gallons per day or 350 AFY) as assumed for the prior project (Condition 20). The Condition 20 plan assumed 300 gallons per day per household for 1066 households to estimate flows to Los Osos Creek. (See Cited Document 3, p. 13 of pdf.) The low estimate above (150 AFY) assumes LOWWP conservation reduces average indoor use to 50 gpcd, 125 gallons per day per household (i.e., 50 gpcd x 2.5 per household x 1066 = 150 AFY). The high estimate (250 AFY) assumes almost all the flow reduction in the perched aquifer would adversely affect Los Osos Creek (a precautionary estimate of the water needed to avoid impacts to steelhead habitat).

**With septic systems left in place, the potential adverse impacts from the LOWWP would be avoided, and a comprehensive community storm water/LID recharge program could be implemented to offset reductions in flows from conservation. Condition 88 (a voluntary rainwater harvesting/recharge program) will not offset project impacts, and the cost of the LOWWP will prevent implementing a strong, comprehensive storm water/LID program.

I.E.3. Evidence that various documents and statements used to support the project are inaccurate, erroneous, or incomplete--and do not justify the project.

I.E.3.a. Resolution 83-13 is obsolete and does not justify the project

I.E.3.a.i. Overview: Resolution 83-13, the zero discharge prohibition which the CCRWQCB and State Water Resources Control Board (SWRCB) approved for about 85% of the Los Osos Community in 1983 and 1984, banned septic systems and required a centralized sewer. The Resolution has driven the efforts to install a wastewater project in Los Osos for the past 25 years, and it continues to drive the current project. This is shown by the EIR.

> *3.1.2 - Project Goals and Objectives*
> *The primary goal of the LOWWP is to construct and operate a community wastewater collection, treatment and disposal system and, thereby, comply with the RWQCB's WDR Resolution 83-13. Eliminating discharges from onsite wastewater, as directed by the RWQCB, will also help accomplish the LOWWP's second primary goal: alleviating groundwater contamination, primarily nitrates, that has occurred at least partially because of the use of septic systems throughout the community* (emphasis added) (See Cited Document 59, p. 3-8.)

The time, energy, money, and liability associated with the attempts to implement the resolution—past project costs and assessments, the on-going building moratorium, enforcement actions, litigation, and associated liability--have led the CCRWQCB and SWRCB to defend and attempt to implement the resolution with stronger measures and fewer justifications. The resolution's troubled history is undoubtedly a major reason agency officials have intentionally provided inaccurate, erroneous, and incomplete information to promote the project. However, none of what happened in the past justifies implementing a project that threatens a sole water source of Los Osos, very high value habitat, and the Los Osos community.

The Water Boards should have rescinded Resolution 83-13 long ago—the result would have been healthier area resources (environmental, social, and economic). **The LOSG is asking the Coastal Commission to use its authority to have Resolution 83-13 rescinded.**

Resolution 83-13 does not justify the project for two main reasons: First, It is obsolete—the science, assumptions, and reasons the Water Boards used to approved it no longer apply, and 2) it conflicts with CEQA and NEPA.

I.E.3.a.ii. **Most of the key findings in Resolution 83-13 have been refuted or no longer apply.** The obsolescence of Resolution 83-13 is clearly shown with an analysis of key findings of fact. (Note that numbering has been added for reference.) (See Cited Document 18, pp. 1-3 for the full text of Resolution 83-13.)

1. *WHEREAS, Los Osos/Baywood park is an unincorporated community, with a 1980 population of 10, 933 persons located out of the City of Morro Bay in San Luis Obispo County; and,*

2. *WHEREAS, current zoning will accommodate a population in excess of 27,000 people and an average residential lot size of about 6600 ft ^{2}; and …*

3. *WHEREAS, the majority of lots are too small to provide adequate dispersion of individual sewage disposal systems effluent; and,*

4. *WHEREAS, the San Luis Obispo County Environmental Health Department has provided documentation concerning the problem of liquid waste disposal in the Los Osos/Baywood Park area; and,…*

5. *WHEREAS, chemical analyses of the wells in Los Osos/Baywood part indicates 38% of the shallow wells tested in the Phase I study, taking water from the Old Dune Sands deposits portion of the aquifer, contain nitrate concentrations which exceed State Health Department Drinking Water standards of 45 milligrams per liter; and,*

6. *WHEREAS, bacterial analyses of 42 wells tested in the Phase I study resulted in <u>26 wells indicating total coliform in violation of</u> State Health Drinking Water Standards, and 2 wells indicating fecal coliform in violation of Basin Plan limits for groundwater; and*

7. *WHEREAS, surface water bacterial analyses tested in the Phase I study indicated total and fecal coliform levels exceeding Basin Plan recommended limits for water contact recreation (REC-1; and,…*

8. *WHEREAS, a Regional Board staff report finds <u>beneficial uses of Los Osos Ground and Surface Waters are adversely affected</u> by individual sewage disposal systems discharges, <u>there appears to be a trend of increasing degradation</u>, and <u>public health is jeopardized by occurrences of surfacing</u> effluent…* (emphasis added)

9. *WHEREAS, Regional Board staff has prepared documents and followed appropriate procedures to satisfy the environmental documentation requirements of both the California Environmental Quality Act, under Public Resources Code Section 21080.5*

(Functional Equivalent), and the Federal Clean Water Act of 1977 (PL 92-500 and PL 95-217), and the Regional Board finds adoption of this prohibition area will not have a significant adverse effect on the environment; … (Emphasis added) (See Cited Document 18.)

The following analyses of these findings show why Resolution 18 is obsolete.

(#1 & 2) The findings regarding projected buildout and concerns about increasing nitrate loading due to population increases do not apply. The projected population of 27,000 in this finding no longer applies. The CDP states that the buildout number for the urban area as 18,428 (See Cited Document 1, p. 58.) Furthermore, the Commission indicated no building will occur within the prohibition zone unless the County meets CDP Condition 6.

> 6. *Wastewater Service to Undeveloped Properties. Wastewater service to undeveloped properties within the service area shall be prohibited unless and until the Estero Area Plan is amended to identify appropriate and sustainable buildout limits, and any appropriate mechanisms to stay within such limits, based on conclusive evidence indicating that adequate water is available to support development of such properties without adverse impacts to ground and surface waters, including wetlands and all related habitats.* (emphasis added) (See Cited Document 62, p. 10.)

Resolution findings related to population in 1983 show the Water Boards' concern that significantly more development would cause unacceptable levels of pollution in the future as the community doubled in size). The fact that the Water Boards authorized 1150 more homes to be built supports the conclusion that the Boards were more concerned about future nitrate conditions than 1983 conditions. (See Cited Document 18, p. 4.) The environmental document for Resolution 83-13 (cited below) clearly shows the Resolution was intended to enable more building. The document states that the project will "…alter the density, or growth rate of the human population...(and)...create a demand for additional housing," yet it does not cite the need for mitigations. (See Cited Document 19, pp. 000430 & 000432.) Further, the Staff Report cites "taxes paid for unbuildable empty lots" as the main reason for rejecting a "no project," option, and it suggests in the next paragraph entitled, "Need for Housing" that growth demand will drive implementation of the project. (See Cited Document 19, p. 000459.)

Due to the urgent seawater intrusion problem, it is uncertain the water supply can even support the current population. The infeasibility of imported water, stable nitrate levels, evidence septic systems do not pollute the estuary or the lower aquifers, and a better understanding of the project's substantial adverse consequences (known and potential)—make today's reality much different from 1983's.

(#3) The finding that lots are too small for on-site disposal systems has been refuted or doesn't apply. The majority of lots are not too small for upgraded and or engineered on-site systems, or small cluster systems, especially with today's technologies (if such systems are required for particular localized problems). However, evidence supports that the vast majority of systems could be retained, possibly with minimal upgrades. As discussed in Section I.E.1.d.iii., comprehensive basin management similar to the San Lorenzo River Watershed Management Plan, with septic system, nitrate, conservation, and storm water management programs --in addition to nitrate treatment at the well --will reduce nitrates, achieve project objectives (and do much more) for much less money. (Also see I.V.D. for overview of alternative.)

(#4 & 8) The findings that surfacing effluent is jeopardizing public health have been refuted or do not apply. The Resolution 83-13 Staff Report bases these findings on County Environmental Health Reports of flooding systems and citizen complaints—i.e., about 15 affected systems in Cuesta by the Sea in 1976 and about 25 throughout the community between 1981 and 1983 (14 in 1981, 1 in 1982, and 10 in 1983). (See Cited Document 19, pp.000479-000478 and 000482-000483.) The problems in Cuesta-by-the-Sea in one year and proximity to the estuary might be cause for concern (although not be justification for centralized project) if they still occurred—which they don't. The number of incidents throughout the community between 1981 and 1983 is not significant. As discussed, the LOSG found no evidence of significant septic system flooding since a storm drain system was installed in the community in the 1990's (See Section I.E.1.b.ii.). As citizens of Los Osos, LOSG members have not heard reports of flooding septic systems, nor have others we talked to. We contacted the person who made the original complaint to the County in 1976 (included in the Resolution Staff Report) and she said she had not seen or heard of any problems with septic systems in Cuesta-by-the-Sea for at least 15 years. We also talked to employees at Al's Pumping and the LOCSD, who said they do not receive reports of flooding septic systems and who further stated that the problem had been remedied with the community storm drain system in the 1990s. The State and Regional Water Boards provided us a County Planning Department list of repairs for 2008 and 2009 in response to our Public Records Act request. The list shows a low annual failure/repair rate of 1% and does not show a concentration of repairs in any one location (e.g., Cuesta-by-the-Sea). (See Cited Document 52.)

The Resolution 83-13 Staff Report cites "inadequate maintenance" as a main reason for septic system failures, and the 1976 County Health Department report recommends better supervision and code enforcement. (See Cited Document 19, p. 000483.) The County most likely provides better supervision and code enforcement of septic systems than in 1983. However, a septic system management program like the program in San Lorenzo River Water (administered by Santa Cruz County) would undoubtedly improve failure rates and performance further. In the past few years, septic system performance has also likely improved due major reductions in water use from conservation--and performance will continue to improve as water use drops further. Conservation improves septic systems performance by reducing septic system loading and by slowing the rate of effluent release.

Performance also improves as the dry zone under septic systems increases allowing greater natural treatment in the soil.

(Note: The above information shows that prior to approval of a Los Osos Wastewater project, an assessment/analysis is needed to determine the effects of conservation since 2004, e.g., groundwater levels, nitrate levels, and seawater intrusion (in the upper aquifer). The information is critical for understanding current conditions.

To the extent septic system flooding still occurs, evidence shows it is an insignificant issue best addressed with improved storm water and septic system management, including improvements to on-site systems as needed. A letter to the Coastal Commission from County Public Health Department in 1980 (included in the Resolution 83-13 Staff Report) explains that storm water runoff is the cause of the problems with septic systems in Cuesta-by-the-Sea, along with inadequate septic system maintenance and code enforcement. (See Cited Document 19, p. 000491-000492.) A letter from the County Engineering Department to the project manager of the Brown and Caldwell studies in 1983 reinforces County Health Department conclusions. It explains that only a few homes were affected by flooding (about 15 near 16th and Paso Robles Streets and "two or three" near 8th and El Moro Avenue). The letter adds that about 450 properties contribute to the 16th Street problem and 700 homes to the El Moro problem. The author emphasizes that assessing property owners for a drainage facility would be difficult. He concludes

> *The solution to the high groundwater problem could be one or more of the following:*
>
> a. *Sub-drainage system*
> b. *Conventional sewer of the area*
> c. *Pressure-mound systems* (engineered on-site systems)
> (See Cited Document 19, p. 000513.)

Thus, a solution to the problem of "flooding septic systems"—other than a centralized wastewater project—was offered to the CCRWQCB in 1983. The County did eventually establish a drainage assessment district in the 1990s that stopped the flooding; however, The County chose to install a conventional storm drain system, which sends surface run off to the estuary and to Los Osos Creek polluting those resources. The CCRWQCB permit for the LOWWP (WDR) justifies the project partly on the basis that it will lower groundwater and reduce polluted pollution from the storm drain system (See Cited Document 11, p. 9.) However, a centralized sewer is obviously not the most cost-effective way to address flooding or storm water runoff. An upgraded, effective storm water system can be installed for under $10 million. (See Section I.E.1.d.iii.) The $190 million project, in fact, is likely to increase polluted runoff due to leaks and overflows in the system, as we show in other evidence. (See Sections I.E.1.b.II. and I.E.1.b.v.) A cost-effective storm water management system, using low impact development (LID) (bio swales and linear parkway/infiltration systems) addresses three issues simultaneously—flooding, storm water pollution of the estuary, and seawater intrusion (by recharging the basin).

(#5 & 8) The findings that 38% of the shallow test wells have nitrate levels above drinking water standards, and beneficial use of groundwater is impaired--and getting worse--no longer applies. Nitrates have stabilized in shallow test wells, with average levels at 10.5 mg/l (0.5 mg/l over Title 22 standards and Regional Basin Plan objectives), with about half of the test wells (53%) exceeding drinking water standards. This represents a modest increase of 15% in 30 years (38% in 1983 to 53% in 2006). Further, there is general agreement among experts including CCRWQCB officials (See Cited Document 23, p. 21.) that nitrates have stabilized. These facts do not support the original finding, which is made on the basis that nitrates will continue to increase rendering the water source less and less usable.

Additionally, the 1983 Resolution did not contemplate nitrate treatment at the well. Currently purveyors plan to treat for nitrates before delivery, as needed at some wells, which will increase the beneficial use of the upper aquifer (Zone C.) Nitrate treatment is needed to increase the beneficial use of the water and a wastewater project is not. If the project does improve average nitrate levels in upper aquifers (Zone A, B, or C) and in some upper basin wells, it will not do so appreciably for decades (i.e., 30 to 60 years). (See Cited Document 39, p. 7 and Section I.E.1.d.i.) Moreover, the project will adversely impact the shallow aquifer and test wells used to justify the project by substantially reducing recharge to the perched aquifer (Zone A). Therefore, the project defeats a key purpose for Resolution 83-13—restoring the highest beneficial use of the shallow aquifer. (See Cited Document 19, p. 000456 and Section I.E.2.c.i.)

To make its case against septic systems, the Resolution 83-13 Staff Report arrives at two key findings which have been disproven: 1) septic systems contribute 91% of the nitrates to the groundwater, and 2) the basin is a single, unconfined aquifer. These inaccurate findings, in combination with findings that the population will double (etc.), supported the CCRWQCB contention that nitrates would pollute the entire basin, and no other feasible alternative existed to reduce nitrates (e.g., nitrate management).

The 91% assumption was refuted by the 2003 Yates and Williams study used to estimate project nitrate reductions in the EIR. The study estimates septic systems contribute 47% of nitrates at the surface, but significantly less by the time flows reach groundwater. (See Cited Document 34, p. 17, and Table 10.) The study's nitrate estimates are for the entire urban area, so septic system loading from the prohibition zone is 13% less (about 41%). Throughout the basin, about 25% of loading is from domestic pets, livestock, natural vegetation, weeds, and irrigated landscaping, so the opportunity for nitrate reduction from management clearly exists (e.g., Xeriscape and reduce fertilizer use). The study further shows the high concentrations of nitrate in water percolating from neighborhoods outside the prohibition zone (low density land use). Basin recharge from properties with horses have the highest concentrations of nitrates (See Cited Document 34, p. 10 and Table 4. Also see Section I.E.1.d.iii.)

The second assumption (i.e., that the basin is a single unconfined aquifer) has been refuted by all basin studies since the late 1980's, including the 2005 Seawater Intrusion Assessment (Cleath and Associates). In fact, the Phase I (Brown and Caldwell, 1983) and the SWRCB study (Richard Zipp, 1979)

completed prior to approval of Resolution 83-13 (studies on which approval of the resolution was based) found upper and lower aquifers to be separated. (See Cited Document 95, p. 18.) However, the CCRWQCB requested the SWRCB to review the finding, and the SWRCB supported the CCRWQCB's one-aquifer theory. (See Cited Document 19, p. 000501.)

The CCRWQCB Staff Report shows the relevance of this conclusion. The Staff Report justifies the project's high costs on the basis that the project would prevent nitrate contaminate the entire basin:

> *…some County representatives are of the opinion that the lower groundwater is a separate aquifer which is protected from shallow groundwater. This is also the conclusion of the Phase I report, although the potential for mixing is acknowledged. Regional and State Board staff disagree with this opinion on examination of the logs… <u>With this assumption, relatively high project costs become less important</u>."* (See Cited Document 19, p. 000459.)

<u>(#6) The finding that many shallow wells have high coliform counts has been refuted</u>. No study since the Brown and Caldwell studies in 1983, including a CCRWQCB water quality study in 1987, mentions high fecal coliform levels in test wells. (See Cited Document 22.) The Brown and Caldwell results were apparently flawed. This fact also supports that septic systems are not polluting the estuary via seeps. (Also see Section I.E.1.b.iii.)

<u>(#7 & 8) The findings that surface waters are impaired have been refuted or don't apply.</u> The finding labeled #7 refers to the Phase I report showing high coliform counts in Los Osos Creek and Eto Creeks. The Staff Report indicates Resolution 83-13 is supposed to restore the beneficial use of Los Osos Creek (recreational use). (See Cited Document 19, p. 000456.) Therefore, the surface waters of concern in 1983 are not the same surface waters the project is supposed to protect per the CDP and WDR--Morro Bay National Estuary (although the claim is refuted by the Kitts study and other evidence presented in this Request—see Section I.E.1.b.i.)

Although Los Osos Creek is listed for fecal coliform per the Clean Water Act Section 303 (d) (2002), the source is stated as "unknown" and the priority level is "low." Therefore, evidence does not support that septic systems are the cause of the pollution. Furthermore, evidence does not support "…a trend of increasing degradation," as the Resolution states. No project document, including the WDR, states that septic systems are the source of fecal coliform in the Los Osos Creek—or that the project will improve creek water quality. A significant source of contamination in the creek is most likely "urban runoff/storm sewers," which is noted as the cause for the "low dissolved oxygen" in the creek. (See Cited Document 94, p. 8.) The conventional storm drain system installed in Los Osos in the 1990s includes a concrete culvert called the "Walker Ditch," which empties into Los Osos Creek from the urban area near Paso Robles and 16th Streets. The CCRWQCB will likely target likely target the Walker Ditch and other parts of the current storm drain system for upgrades with a mandated storm water management plan (SWMP), but the LOWWP will make a better storm water management system unaffordable. (See Section I.E.1.b.ii.)

Therefore, Resolution 83-13 does not justify the project because available evidence shows

- The project will not restore use of the shallow aquifers--and will adversely impact them.
- Nitrates are not getting worse—they have stabilized and purveyors plan to treat for nitrates in the short-term, while nitrate management will reduce nitrates in the long term.
- Septic systems are not threatening the estuary or public health—pollution from groundwater seeps and runoff is insignificant, and the minor issues that may still exist are much more cost-effectively addressed with a septic system and storm water management program; also, the project can harm the estuary and risk life and property.
- Contaminants from the upper aquifer will not pollute the lower aquifer—the minor threat they may pose is reduced further with more pumping from the lower aquifer and other management measures (See Section I.E.1.c.iv.)
- The population of Los Osos will not double (and may not even increase)—so nitrate loading from further development will not further degrade the water supply, while conservation, septic system, nitrate, and storm water management will achieve project objectives (reduce contamination) and reduce/stop pollution of the estuary(which results mainly from urban runoff)—while comprehensive management—without the project—also provides the best chance for stopping seawater intrusion and basin sustainability.

I.E.3.a.iii The Resolution environmental documentation required for CEQA compliance highlights why the Resolution is obsolete and should not have been used to guide project review and development.

CEQA allows the CCRWQCB to use an abbreviated environmental review process (a checklist) when adding an amendment to the Regional Basin Plan (Resolution 83-13 is a Basin Plan amendment.). However, some key findings highlight the Resolution's lack of relevance/applicability to the current project.

> *Population. Will the proposal alter the location, distribution, density, or growth rate of the human population in the area?* ***(Yes)***
>
> *Housing. Will the proposal affect existing housing, or create a demand for additional housing?* ***(Yes)***
>
> *Earth. Will the proposal result in: a. Unstable earth conditions or in (sic) changes in geologic substructures?* ***(No)***
>
> *Human Health. Will the proposal result in: (a.) Creation of any health hazard or potential health hazard? (and) (b.) Exposure of people to potential health hazards?* ***(No)***
>
> *Natural Resources. Will the proposal result in: b. Substantial depletion of any nonrenewable natural resource?* ***(No)***
>
> *Energy. Will the proposal result in: a. Use of substantial amounts of fuel or energy?* ***(No)***
>
> *Mandatory Findings of Significance. Does the project have impacts individually limited, but cumulatively considerable? (and) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?* ***(No)***
>
> (See Cited Document 19, pp.000428-000432.)

The above environmental findings verify that the Resolution is intended to increase building—and even promote or induce growth, i.e., "…create a demand for housing." This impact is not identified as an adverse impact, requiring mitigation; instead, it is considered a beneficial impact of the Resolution. Further, these findings show that Resolution 83-13 ignored the substantial increased impacts of a centralized project on health and safety and geology (due to earthquakes), air quality, and non-renewable resources. (The FEIR estimates 400,000 gallons of fossil fuel will be used—see Cited Document 28, p. 3-832.) Significantly, the environmental document does not mention the potential adverse impacts on water quality/supply despite the 1973 DWR and 1979 SWRCB study (both cited as source documents for the Staff Report) warning that removal of septic systems could cause seawater intrusion. (See Cited Document 19, p. 000439; Cited Document 95, 000246; and Cited Document 96, p. 45.)

<u>The environmental document also does not identify the least environmentally harmful feasible alternative, as required by CEQA (Section 21080.5).</u> The environmental document eliminates the "no action" alternative, citing the Resolution findings above (which are refuted or no longer applicable) and the Staff Report rejects the "No project" option, in large part, because it would not allow building to occur (See Cited Document 19, p. 000427, 000430, and 000459.) The environmental document also mentions a more restrictive option (larger prohibition zone and shorter time to cease discharges) and a less restrictive option (leaving septic systems in place with a septic system maintenance district). However, it rejects both citing rapidly percolating soils and surfacing/high groundwater as the reasons for rejecting the maintenance district, which, the Staff Report says will not be addressed by "increasing the frequency of septic tank pumping" (See Cited Document 19, pp. 000427.) Thus, Staff reduces the maintenance/management option to "more frequent pumping." Thus, the Staff Report fails to consider upgraded/engineered on-site systems as provided for in Resolution 83-12 (the on-site Regional Basin Plan on-site provisions implemented the prior year) nor does it consider a mix of on-site and cluster systems or comprehensive management (recommended in the 1973 DWR study and implemented in Santa Cruz County in 1979). (See Cited Document 96, p. 46; and Cited Document 15, p. 1.) Further, the Staff Report does not consider the unique Los Osos soils which slow the percolation rate and provide greater natural treatment. (See discussion in Section I.E.1.d.iii.)

<u>The Staff Report and environmental document highlight two other reasons the Water Boards implemented Resolution 83-13—i.e., funding and the failure of the County to manage the resource.</u>

The environmental document clearly states that a main purpose for Resolution 83-13 was to obtain project funding.

> *"This resolution has a direct impact on the Clean Water Grant (CWG) funding for the Los Osos/Baywood Park area. <u>By establishing a prohibition, this project will be given an A priority, greatly increasing its funding potential</u>."* (See Cited Document 19, pp. 000433.)

The Staff Report also refers to the County's failure to monitor groundwater quality and septic system failures as reasons for the Resolution, pointing out the County Building Department has regulatory responsibility for on-site systems. (See Cited Document 19, pp. 000452 & 000460.) The CCRWQCB 83-12 Staff Report states that the Porter-Cologne Water Quality Control Act (Section 13282) "…provides for continued discharge of on-site systems if repairs are made and an authorized public agency assures the Regional Board that such systems will be adequately constructed and maintained." The report adds, "No authorized public agency has assured the Regional Board that these (septic system) failures can be corrected and prevented in the future." (See Cited Document 19, pp. 000433.)

In Santa Cruz County, County Environmental Health Services stepped in to manage of the area's septic systems as part of a comprehensive watershed management plan, integrating septic system, nitrate, and storm water management (recharge). (See Cited Document 15, pp. 1&2.) In 2000, the septic system management program served approximately 13,000 properties and over 30,000 people, well over twice the number of people and properties in Los Osos.

<u>Resolution 83-13 has not only driven the project process but is responsible for poor basin management and the increasingly serious seawater intrusion problem.</u>

Resolution 83-13 has had negative effects on basin planning leading to the critical seawater intrusion in two ways. 1) It has essentially frozen basin planning in place, making nitrate reduction and a centralized sewer the starting points for all basin planning, and 2) it has influenced studies and reports, pushing science and official findings towards outcomes/conclusions that support the Resolution and a centralized wastewater project.

After 1983, the question of how the basis is best managed came down to a question of how it is best managed with a centralized sewer. Despite more and more evidence contradicting or not supporting Resolution 83-13, the fact that the CCRWQCB had enacted an order requiring the elimination of septic systems in the prohibition zone dominated the thinking of planners and consultants. This is best captured in the first project study done after implementation of 83-12 by Engineering Science (ES) in 1986:

> *The project history has included debates about the hydrogeologic characteristics of the groundwater basin, the <u>merits of preserving the quality of the shallow groundwater</u> which currently is <u>not used as a primary water</u> source, the <u>potential for degradation of the deeper groundwater which is the primary water source for the area</u>, and the use of other types of systems in lieu of a sewerage of a sewerage system to protect groundwater quality in the area. An ongoing concern of the County and Los Osos/Baywood Park residents is the financial implication of an area-wide sewerage project. This financial implication was emphasized in the Phase II facilities Plan user fee estates of $60 per month. <u>However, in light of the Regional Boards' (sic) 1983 amendment to the Basin Plan, a sewerage project appears inevitable.</u> This Phase I Planning Study has therefore undertaken to determine the*

most cost-effective sewerage system to serve the area. (Emphasis added) (See Cited Document 97, p. 1-4.)

The ES study identifies the objective of the project as providing a cost-effective, centralized sewer and the purpose of the project to protect and preserve the groundwater "as mandated by the Regional Board." It further states

> *…A paramount objective for this project is to maximize recharge of the Los Osos groundwater basin with treated effluent from the project wastewater treatment facilities.* (Emphasis added.) (See Cited Document 97, p. 1-5.)

However by the end of the study, it states:

> *After the investigation of five potential sites for recharge of the treated effluent to the lower aquifer, it was determined that no feasible sites for direct lower aquifer recharge exist. Recharge of the upper aquifer (and potential indirect recharge of the lower aquifer) is now planned via a combination of discharge to the Los Osos Creek during dry weather and to percolation ponds during wet weather* (at the Broderson site). *Discharge to Los Osos Creek may result in direct recharge of the lower aquifer zone. The percolation ponds will be located at Site 6 south of Los Osos and near the Broderson Road near the southern and upper edge of the upper aquifer zone.* (Emphasis added) (See Cited Document 97, p. 11-3.)

Thus, by the end of the study these experts realized that the "paramount objective" of recharging the basin, especially the lower aquifer (the source of the community's water supply), would be impossible to ensure. Even the best locations for recharge had considerable uncertainty, and like current studies, the ES study did not address the issue of time delays in recharge. The CSUMB Watershed Institute states that water recharged at the surface will require over 300 years to reach the lower aquifer. (See Sections I.E.2.C.iii and I.E.2.c.iv.) The ES plan does, apparently, make some attempt to address the liquefaction risk at the Broderson site (a known problem in 1986) by locating the leach fields 200 feet from of the nearest homes. (See Cited Document 97, p. 8-14.)

In the late 1980's and 1990's studies began to show that recharge of the basin was not only possible with surface percolation, but that it would increase basin yields. These findings supported the wastewater project in two ways—by showing that effluent disposal could recharge the lower aquifer (the project could be mitigated) and by showing septic systems would eventually pollute the lower aquifer (which supported the CCRWQCB's original claim that nitrates would pollute the entire basin). Purveyors also liked the theory because it meant lower aquifers were being recharged at a faster rate than previous studies indicated. This meant purveyors were not over drafting the lower aquifers as much as previously believed and could continue pumping from the lower aquifer without significant changes. The new findings resulted in higher safe yield estimates for the lower aquifer despite little data at the time on seawater intrusion. The following except from the 2005 Seawater Intrusion Assessment confirms that, after over 30 years of septic systems use, no nitrate pollution of the lower

aquifer had been detected. It also chronicles the discussion/debate (which continues today) regarding how much the upper aquifer recharges the lower and the potential for nitrate contamination of the lower aquifer.

> *Analysis of hydrochemical data has shown that ground water quality from lower aquifer production wells is closer in composition to Los Osos Creek alluvial water than to upper aquifer water (Brown & Caldwell, 1983). In 1988, however, the U.S.G.S. (Yates and Wiese) published a report on the Los Osos Valley ground water basin where the following observations were made based on results of a numerical model of the ground water basin (page 50):*
>
> > *"The downward head gradients have important long-range water-quality implications. Even in the western part of the basin, where there is an apparently continuous clay layer, model results indicated that a significant amount of recharge to deep strata must come from downward percolation of return flow. Seepage from Los Osos Creek is insufficient to supply present pumping rates, and the absence of widespread seawater intrusion indicates the ocean is also not the principal source of supply. The most likely source is downward percolation of return flow. Although at present only shallow wells have been affected by poor-quality return flow, it is likely the deep wells eventually also would be affected."*
>
> *A subsequent review of nitrate concentrations over time in deep aquifer production wells showed no historical trend of increasing nitrates in the deep aquifer, while shallow aquifer nitrate concentrations were climbing (Metcalf & Eddy, 1994, Task F). These findings suggest that hydraulic communication between the upper and lower aquifer is significantly restricted by the regional AT2 clay aquitard, despite the U.S.G.S. model findings.*
>
> *The basin model was later modified by URS Corporation in association with Team Engineering (2000), although the conclusions as to the principal source of recharge to the basin (septic return flows) did not change. The current basin model (Yates and Williams, 2003) also operates with the majority of recharge to the lower aquifer coming from upper aquifer leakage through the regional aquitard.* (Emphasis added) (See Cited Document 37 p. 13.)

Based on steady state modeling (i.e., water levels in sample wells remaining relatively static with higher levels of pumping), the USGS Yates and Weiss study increased the estimated yield of the lower aquifer substantially. However, the authors had little data on seawater intrusion, and assumed well levels remained static because water from the upper aquifer replaced the water being pumped. Subsequent evidence, including accelerating seawater intrusion, supports that they could have underestimated the input from seawater intrusion. (See Cited Document 37, p. 13.)

The 2005 Seawater Intrusion Assessment continued to support the Yates and Weis USGS study and the conclusion that most recharge of the lower is from the upper aquifer (i.e., 910 AFY from upper aquifer, 420 AFY from Los Osos Creek Valley, and 560 from seawater intrusion). The study used the

USGS model along with chemical analysis and age dating. However, in 2009 the same expert (Spencer Harris of Cleath-Harris Geology, Inc.), using a "dual density" steady state model revised the safe yield for the lower aquifer down from about 1500 AFY to about 600 AFY. (See Cited Document 40, pp. 6 & 7.) This indicates that estimates of upper recharge of the lower aquifer could have been overstated. Accelerating seawater intrusion (moving 12 times faster than the 2005 Seawater Intrusion Study predicted) provides evidence that the upper aquifer does not recharge the lower aquifer at the levels simulated with the model.

The EIR finding that 0.22 or 22% of the water disposed in Broderson leach fields will leak to the lower aquifer from the upper is based on the pre-2009 model. Eugene Yates lists several sources of uncertainty and concludes that the model has a "substantial" level of uncertainty (See Cited Document 36, p. 5.) The need to substantially increase pumping from the upper aquifer adds significant uncertainty. Eugene Yates points out that using the model to estimate yields without basing the findings on empirical evidence (i.e., scenarios that have never been tried) substantially increases modeling uncertainty. (See Cited Document 36, pp. 1 & 2.) This highlights why Broderson disposal does not provide measurable mitigation for seawater intrusion in the upper aquifer or the lower. (Also see discussion of Broderson disposal in Section I.E.2.c.iv.)

As project documents show (for this project and the prior project) Broderson disposal is not certain to work. Project planning allows for the possibility that recycled water will not percolate to the upper aquifer and/or the lower as planned, resulting in water surfacing downhill or mounding under the Broderson site causing water quality issues (due to inadequate groundwater separation). As a result of the uncertainty, the measure will be tested for two years and monitored. The prior project provided harvest wells to remove the excess water in the aquifer, also to augment the domestic water supply and offset pumping from the lower aquifer. The present project reduces the water disposed at Broderson to 448 AFY from 900 AFY, and it provides almost no pumping offset (i.e., from conservation and recycled water use programs.) This project also does not account for the time delay or salt build up and liquefaction risks. (See Sections I.E.2.d. ii. and I.E.2.d. iii.)

The ES study accurately reflects the uncertainty of Broderson recharge—a high level of uncertainty that remains today—although the uncertainty is not reflected in project documents or official statements. The 2005 Seawater Intrusion Assessment acknowledges that the permeability of the Regional Aquitard has not been directly measured and the exact mechanisms and pathways of recharge are not known. Studies also show recharge to the lower will be extremely slow. The CSUMB Watershed Institute estimates it will takes 171 years for water to move through the regional aquitard. Broderson recharge of the upper aquifer will also be very slow (20 years to reach the pumping depression under the downtown area according to the Institute), and Eugene Yates states that Broderson recharge will not reach habitat along the estuary fringe. (See Cited Document 36, p. 4 and discussions in Sections I.E.2.c. ii. through I.E.2.c.iv.)

The effort to support Resolution 83-13 and its early findings (e.g., the finding that septic systems will pollute the entire basin and percolation of treated effluent will mitigate for the project) have resulted in basin studies and findings underestimating and ignoring the seriousness of seawater intrusion while overestimating the influence of the upper aquifer on the lower. In this way, Resolution 83-13 has pushed basin studies towards findings/conclusions that have lead to the critical seawater intrusion problem. These findings/conclusions include: 1) The rate of pumping from the lower aquifer could be continued (i.e., safe yields could be increased in the late 1980's and early 1990's) without serious harm to the basin.) 2) Effluent disposal (e.g., at the Broderson site) will provide safe, certain mitigation for a wastewater project's impacts on the community's main water supply, the lower aquifer. The first conclusion has caused (and will continue to cause) seawater intrusion in the basin, and the second will most likely cause seawater intrusion in the future--if the project is implemented.

Resolution 83-13 has also resulted in the scrapping of least two water management plans, one in 2000 and one in 2005, that might have averted the seawater intrusion crisis. These management plans were abandoned when wastewater projects were stopped. Both plans included conservation components and both would have shifted pumping to the upper aquifer, possibly averting the critical seawater intrusion problem (although the 2005 plan also called for importing water to allow build out.) Officials have repeatedly put comprehensive conservation and shifts in pumping (i.e., better basin management) on hold waiting for project implementation although project implementation is not necessary to implement the measures.

Ironically, Resolution 83-13 (driving the current project) continues to thwart effective basin management by focusing scarce funds on a minor nitrate problem, while delaying management actions and decisions needed to preserve the lower aquifer and the basin. Knowing that project impacts on the upper aquifer will be substantial, purveyors are undoubtedly putting off expensive shifts in production to the upper aquifer.

Therefore--while the science and findings behind Resolution 83-13 have not withstood the test of time—and current evidence shows a centralized wastewater project will do more harm than good to the water supply--Resolution 83-13 continues to drive the process forward, carrying its baggage from the past, exerting influence over the future. **This is why the LOSG requests the Coastal Commission uses its authority to have Resolution 83-13 rescinded.**

I.E.3.b. AB 2701 does not justify the project because it is based on the inaccurate finding that the project is urgently needed to protect public health and safety.

Like the CDP, a key assumption on which AB 2701 is based is that "There is an urgent need to protect the health and safety of the public." (See Cited Document 162, p. 2.). This assumption is not accurate as shown by the evidence in this Request.

I.E.3.c. A recent Superior Court decision does not justify the project because it is based on inaccurate, erroneous, and incomplete information (i.e., is not based on substantial evidence.)

A recent Superior County decision supports Resolution 83-13 as a basis for CCRWQCB enforcement actions against Los Osos homeowners accused of illegally discharging "waste" from their septic systems. However, the decision relies on inaccurate and erroneous information, much of it the same disproven science, findings, and other evidence used to support Resolution 83-13. For instance, the Court decision cites the inaccurate finding that 91% of the nitrate loading in the basin is from septic systems and it refers to the groundwater becoming "increasingly degraded" and "the increasing seriousness" of the problem, also the "public health threat" from a "high groundwater table, which causes septic system failures and surfacing of effluent." (See Cited Document 98, p. 3.) As shown in this Request, these claims have been refuted by more current evidence. (See Section I.E.3.a.) The Court decision also does not address the issue of whether the CCRWQCB has the right to prescribe a centralized project—which Resolution 83-13 clearly does--although the Water Code does not allow the CCRWQCB to select the method of compliance. The inequity/inconsistency of the enforcement action is highlighted by the fact that the CCRWQCB is prohibiting "illegal" discharges from individual septic systems, but the CCRWQCB has granted a discharge permit for Broderson disposal. Some on-site systems can reduce nitrates to below the limits set for Broderson discharge (e.g., the Lombardo Associates, Inc. Nitrex systems reduce nitrates to 3 mg/l versus the 7 mg/l discharge limit of the LOWWP). Justifying enforcement actions on the basis of Resolution 83-13 is not a supportable position based on current evidence.

I.E.3.d. Successful Proposition 218 and Rates and Charges assessments do not justify the project. Community members had received inaccurate, erroneous, or incomplete information provided by County and CCRWQCB officials prior to the assessment vote/protest, and they were facing the threat of enforcement action.

I.E.3.e. The CCRWQCB WDR and Staff Report do not justify the project (and confirm that the project is not justified). After acknowledging that nitrate contamination was nearing equilibrium in 2006 and that purveyors will be treating the upper aquifer for nitrates, the WDR Staff Report justifies the project on the bases that tests show an "exceedance of nitrate in some wells" and "Discharge of waste to the waters of the state is a privilege, not a right…" (See Cited Document 23, p. 21.) [Note: The 2005 nitrate monitoring study we include in attachments has a CCRWQCB date stamp of Nov. 9, 2005, so CCRWQCB officials were aware that nitrates had stabilized prior to the June 2010 Commission hearing. (See Cited Document 33.)]

Elevated nitrates in some test wells do not justify a $190 million project, especially since most of the test wells tap the perched and transitional aquifers (Zones A & B). These wells, used by some private well owners and considered for use by water purveyors, will be adversely affected by the project, reducing the beneficial use of this water source. Adverse impacts on Zone A defeat an important purpose for Resolution 83-13, to increase the beneficial use of the shallow aquifer. (See Cited Document 18, p. 3.) Furthermore, the project is not needed to increase the beneficial use of the production upper aquifer zone (Zone C). Purveyors now pump and deliver water from the upper aquifer, blending it as needed, and they plan to treat the water from some wells in the future to increase the beneficial use of the aquifer. Also, other options are available to reduce nitrate concentrations including well relocation and septic system and nitrate management. These options are much more cost-effective than the LOWWP. The total cost for the measures would be less than 1/10th the project cost. (See Part IV.D.)

As discussed in I.E.1.b.i., the WDR claims that the project is "vital" to achieving Clean Water Act Section 303 (d) goals (TMDLs) for pathogen reductions in the estuary, but the Kitts study cited in the CCRWQCB WDR refutes that. The CCRWQCB requested the Kitts study and the SWRCB funded it. Therefore, CCRWQCB and SWRCB officials knew and understood the results of the study and what the results meant. However, they intentionally provided inaccurate, erroneous, or incomplete information about the study to have a wastewater project implemented.

The WDR clearly shows that significant potential benefits of the project on the water supply and public health and safety are non-existent. The main reasons for approval of Resolution 83-12 have disappeared, and the project by June of 2010, could make seawater intrusion worse in the basin and otherwise harm the water supply. Therefore, the WDR provides substantial evidence that the project will do more harm than good. The only possible justification for spending $190 million on a water quality project that does not address a real and substantial threat to health and safety would be if the project provided a very substantial and measurable increase in the water supply. The LOWWP is likely to reduce the water supply, and it is not needed to increase it. The WDR further provides substantial evidence that CCWQCB officials had this crucial information in June of 2010, but did not disclose it to the Commission.

<u>I.E.3.f. The CCRWQCB and SWRCB's rejection of the Citizens for a Sustainable Community (CSC) and LOSG's requests for an SEIR do not justify the project.</u> The LOSG supported the Citizens for a Sustainability Community (CSC) objection to SWRCB approval of an SFR loan for the project and the CCRWQCB's approval of the WDR submitted by Angel Law. We also appealed the WDR to the SWRCB. These objections and appeal requested a subsequent EIR (SEIR) on the basis that accelerating seawater intrusion and purveyor plans to address it constituted substantial changes in the conditions under which the project was approved, causing new adverse impacts and providing opportunities to minimize or avoid impacts. We also pointed out that the project required further mitigation for high

salt content in the water that could degrade the aquifers. (See Cited Document 49, Cited Document 25, and Cited Document 84.) The SWRCB and CCRWQCB rejected our appeals. The SWRCB and CCRWQCB claimed the purveyor basin plan does not constitute a project with cumulative impacts. They also claimed accelerating seawater intrusion moving 12 times faster than the EIR stated did not constitute changed conditions. The failure to grant reasonable requests for subsequent EIRs show that the SWRCB and CCRWQCB are not committed to project mitigation and basin sustainability. Neither is willing to slow this project down to ensure it is mitigated. Both have a lot at stake; the SWRCB included a $6 million repayment of a contested loan from the prior Los Osos project in SRF funding, and the CCRWQCB is involved in pending enforcement actions and related litigation. Several of the randomly-selected residents subjected to enforcement action have appealed the Superior Court decision discussed above. (See Section I.E.3.c and Superior Court Decision, Cited Document 98.)

I.E.3.g. ISJ Working Group support does not justify the project nor ensure the project will do more good than harm. The Commission Staff Report of May 27, 2010, cites a statement in the May 4, 2010, *Los Osos Groundwater Basin Update* (Cited Document 47) to support the benefits of the project and its potential to mitigate for impacts.

> *The ISJ Working Group recognizes the above-listed LOWWP actions are crucial to mitigating the negative impacts with which the Los Osos community is faced and that implementation of these measures should be pursued as soon as possible.* (See Cited Document 1)

ISJ Working Group "support" of LOWWP ground water mitigation measures and the project does not mean the project the project will mitigate for adverse impacts or benefit the basin. For one thing, a statement of general support does not mean support for specific measures nor does it mean purveyors will agree to implement measures, as required in some cases for measures to mitigate impacts. A main reason Condition 5 and the Draft Recycled Water Management Plan do not mitigate for impacts on seawater intrusion it that measures are not specific, measurable, and enforceable--and a main reason they are not is that they rely on purveyor support. For the conservation and the recycled program to offset pumping of the lower aquifer, purveyors must reduce pumping in specific locations. Currently, they have neither the infrastructure nor cooperative arrangements in place to do so (e.g., cooperative nitrate treatment, blending, and intertie arrangements). Counsel for GSWC, in a letter to the County Planning Commission in May 2009, confirms conservation does not ensure pumping will be reduced where it mitigates seawater intrusion. (See Cited Document 73, pp. 2 & 3.)

Furthermore, purveyors are not certain to support the recycled water program. The program could reduce purveyor revenues and it will involve accepting legal responsibility for the water, which is considered a pollutant. They may not want to take on the regulatory requirements and potential liability. Purveyors are undoubtedly also concerned about the salt content of the water and the possibility that water customers will not want it at any price.

Furthermore, purveyor support does not mean that purveyor water management will be effective in stopping seawater intrusion. Purveyors have allowed seawater intrusion to get worse over the years and their goals are not well aligned with project conditions. They have tended to focus on the short-term bottom-line, rather than the long-term health of the resource. One place where goals are not well aligned is conservation, which can reduce revenues. Golden State Water Company (GSWC) is a private company whose first priority is shareholder profits. The County allowed the ISJ Working Group to develop the project conservation program, and the program is not consistent with the Final CDP. Special Condition 5 requires reducing water use "as much as possible…as soon as possible." (See Cited Document 62, p. 9.). Peter Mayer, a nationally recognized expert, states that more conservation could be achieved sooner (See Cited Document 75, p. 5.)

Also, the Draft Recycled Water Management Plan (RWMP) shows the County will rely on the ISJ Working Group for developing and implementing the Condition 5 Monitoring Program (including "success criteria") and the Reporting and Adaptive Management Program. However, purveyors are not required to meet CDP conditions and they will not set specific, measurable, and enforceable objectives that require them to stop seawater intrusion by a specific state. Further, the draft RWMP indicates that the County will rely on the ISJ "Basin Plan" to satisfy requirements for a management plan pursuant to AB 3030 and SB 1938. Such plan will undoubtedly form the basis for a groundwater ordinance if the County implements an ordinance. Therefore, such ordinance will not have specific, measurable, and enforceable objectives for stopping seawater intrusion or ensuring a benefit from the project. In fact, benefits cannot be ensured due to unmitigated project impacts and the infeasibility of some measures. As a result, neither the County nor individual purveyors will be held responsible for any particular outcome or benefit from the management plan or project.

Additionally, Golden State Water Company (GSWC) has no incentive to enter into a basin plan agreement with the LOCSD since a bankruptcy court many require the LOCSD to sell the water utility, and GSWC is the most likely purchaser. Signing an agreement for cooperative arrangements that benefit the LOCSD is not in GSWC's immediate interest (although the lack of a cooperative agreement results in continued seawater intrusion.)

Further, the project is likely to interfere with development of purveyor agreements to stop seawater intrusion. Purveyors know that Broderson leach fields are uncertain to work and the project would severely impact the upper aquifer. They will be reluctant to commit resources to shifts in pumping to the upper aquifer knowing it may be a waste of resources. (Also see Sections I.E.2.e.i through I.E.2.e.iii and Section I.E.2.i.)

<u>I.E.3.h. The Environmental Assessment (EA) that the County submitted to the USDA shows the County's intent to misrepresent the project benefits, adverse impacts, and alternatives.</u> The Environmental Assessment (EA), which the County sent to the USDA to obtain funding, contains substantial inaccurate, erroneous, and incomplete information showing the County's intent to misrepresent the benefits of the project. The following passage provides a good example.

Septic tanks in the wastewater service area currently discharge 1,237 acre-feet of septage to the shallow groundwater annually. This represents approximately 28% of the flow into the groundwater under the service area. However, because it is discharged near the surface, approximately 90% of the septage flows out of the groundwater system and into Morro Bay and the ocean. Therefore, the current method of wastewater treatment and disposal results in the annual loss of 1,113 acre feet of groundwater. The LOWWP will collect the wastewater and return the recycled water to the groundwater system through the Broderson and Bayridge leach fields, and through replacing groundwater pumped for irrigation. Together with the water conservation program, the LOWWP reduces the annual groundwater outflow lost as a result of wastewater treatment to 339 acre feet (the volume of discharges at Broderson and Bayridge that does not percolate to the lower aquifers). This results in a net annual benefit of 774 acre feet to the existing water supply. The 339 acre feet "lost" to the groundwater system will serve to maintain near surface water levels in wetlands located at the Bay front, mitigating any related biological impacts from collecting the septage in a centralized treatment system. Consequently, the Project's effects on groundwater, water quality, and water supply are overwhelmingly beneficial
(See Cited Document 99, pp. 69 & 87.)

This groundwater analysis the County provided to the USDA (in particular the statements underlined) are not consistent with any basin study or finding. It provides inaccurate and erroneous information, which deviates substantially from basin studies used in project development and all information in the record we could find, greatly exaggerating the potential negative effects of septic systems and the benefits of the project. Septage includes waste solids, which do not leave septic tanks and cannot pollute the estuary. As discussed in Section I.E.1.c., available evidence does not support that septic systems pollute the estuary with pathogens or nitrates. By the time the upper aquifer water flows to the estuary (becomes outflows) it is drinking standards. Outflows in fact are needed to repel seawater intrusion and maintain the integrity of the aquifers. Furthermore, the EIR does not show a "net annual benefit…to the water supply…"and it shows the project will reduce flows to habitat potentially adversely affecting habitat. (See Sections I.E.1.b and I.E.1.c. for further discussion.) (Note: The EA further does not even mention potential earthquake impacts.)

(Also see the Addendum to the SRF and WDR objection and comment submitted to the SWRCB and CCRWQCB by Angel Law on behalf of CSC, which cites the USDA/County violations of NEPA and USDA policy (See Cited Document 49.) The document was also submitted to the Visalia USDA office.)

I.E.3.i. A statement by Gordon Hensley, LOCSD Director in 2005, shows one possible reason the County and CCRWQCB misrepresented the project as providing a significant benefit to the National Estuary—to obtain federal funding.

> *I don't have a question. I would like to – We've talked about this before to sort of bring this back into perspective that the point of this study was not about septic tanks in Los Osos and the important issue for us in our situation is how do we finance a very expensive project. The best news in this project for us is that there is human fecal contamination coming from the seeps into the bay. Now while that may not seem like good news what that does for us is builds a bridge between our need to fix our problem and Federal money. That gets us to the National Estuary Program at which we can use that to draw in the Federal government to assist us in financing it. That's the most important aspect. It's not about how much of a contribution and how much of a contribution others are making to the contamination of the bay. For our purposes the main issue is that we can make a connection to Federal dollars and that's what's the most important thing to us. But thank you for coming. (*Gordon Hensley, CSD Director, Community Services District Meeting, 10:34 PM, July 7, 2005, during Dr. Kitts presentation of the 2002 study)

Part II. The project's adverse impacts and risks far outweigh its benefits.

II.A. Overview

As shown in Parts 1 & 2 of this Request, the benefits of the project have been substantially and intentionally exaggerated. Official claims that septic systems pose a significant threat to the estuary, the basin, and public health and safety are not accurate. Available evidence supports that current basin conditions (except for seawater intrusion) are sustainable. Existing conditions are sustainable, in large part, because septic systems supply beneficial groundwater flows to maintain aquifer levels and support habitat. Forty years of septic system use with no significant adverse impacts on the estuary or public health—with nitrate levels stabilized in the upper aquifer and purveyors planning to treat the upper aquifer water as needed--provide substantial evidence that existing septic systems do not threaten resources, but instead benefit resources.

Furthermore, present conditions can be enhanced with long-overdue, cost-effective, comprehensive management measures including septic system, nitrate, storm water, and conservation programs. On the other hand, the project poses a substantial threat to the basin and habitat by causing major disruptions in groundwater flows that require complex, expensive, yet to be developed, uncertain, and, in some cases, infeasible mitigation programs. Thus, the project pours a tremendous amount of community resources into a project that addresses a non-threat—nitrates—while significantly increasing an urgent, immediate threat--seawater intrusion. Basically, the project risks the vital resources it is meant to protect for virtually no benefit. When known (unavoidable) project impacts are added to the equation, it becomes abundantly clear that the project does more harm than good to resources--and is an extremely poor use of scarce financial resources.

II.B. Seawater intrusion poses the real threat to basin sustainability—and the project will only make it worse.

The seawater intrusion front advanced about one-half mile through the large lower aquifers of the basin between 2005 and 2009, over twice as far as it had in the previous 20 years (1985 to 2005). In those four years, seawater contaminated about 15,000 acre feet of drinking water, about a five years' supply for the entire area relying on the basin including farms. Seawater destroys water for most uses at very low concentrations, and seawater intrusion is very difficult to reverse. It is not reversible when salt concentrations reach high levels. Since the 1980's, a large portion of the lower aquifers has been permanently destroyed by seawater intrusion, and the destruction continues. (See Cited Document 47).

The large lower aquifers (Zones D & E) supply about three-fourths of the water for the urban area. They are about ten times larger than the upper aquifer (the focus of the project) and they extend only four to five miles inland. Particularly alarming is the fact seawater intrusion accelerated by 12 times at the same time the community reduced water use by about 30% (700-800 AFY between 2004 and mid 2011). A half-mile advance in the seawater front under these circumstances clearly shows the imminent threat seawater intrusion poses to basin sustainability, and the seriousness of the problem relative to elevated nitrates in some wells in the upper aquifer. Nitrates have stabilized and do not pose a threat to the water supply. In fact, water high in nitrate (NO3) is desirable for crops. In fact, parts of the upper aquifer high in nitrates could be used for irrigation; whereas water high in salts (NaCl) not only destroys crops, but can permanently destroy soils and aquifers (See Cited Document 13, pp. 3 & 4.)

One gauge of the seriousness of the problem is how fast seawater intrusion is contaminating a major supply well. The Palisades well, which supplies about one-fourth of the water to the urban area (one-half of the water the LOCSD produces) has chloride levels as of May 2011 of 398 mg/l. Chloride is an indicator of seawater intrusion. Water is not recommended for drinking at 250 mg/l, and purveyors cannot pump it at 500 mg/l. Chloride levels at the Palisades well climbed from 60 mg/l in 2002 to 360 mg/l by January of 2010 and by May of 2011 (almost a year ago) were 398 mg/l.

The WDR for the LOWWP downplays seawater intrusion by indicating it progressed in "fingers" between 2005 and 2009. (See RWQCB WDR, p. 3.). However, the Basin Update reports that it also moved inland in a broad front. (See Cited Document 47, p. 3 or Cited Document 11, p.3.) Eugene Yates, an expert on the basin and seawater intrusion, stresses that the Los Osos condition is "extremely urgent" and that major pumping changes are needed along with aggressive conservation—but that pumping changes can cause seawater intrusion in conjunction with the project. The CSU Monterey Bay Watershed Institute and Mr. Yates warn that seawater intrusion threatens the Los Osos basin as a water source for the community. The substantial evidence we provide in this Request confirms the project substantially increases that threat.

Finally, Los Osos has no other feasible sources of water. The environmental, economic, social, and technical factors involved in replacing the basin--even augmenting the basin--as a water source are insurmountable, especially with the very costly wastewater project.

<u>Thus, to achieve a reduction in nitrates in some upper aquifer wells over 30 to 60 years, the LOWWP risks the basin--the only feasible source of water for the area.</u>

II.C. Potential Project benefits are non-existent when offsetting factors are considered.

II.C.1. Overview: The groundwater improvement objective for the project is to "alleviate (reduce) contamination—primarily nitrates…that results at least partially from septic system use throughout the basin." (See Cited Document 59.) After more than 40 years of septic system use, elevated nitrate levels in some upper aquifer wells is the only adverse effect of septic systems. Other contaminant levels in the upper aquifer remain within drinking water limits, nitrates have stabilized, purveyors currently pump from many the upper aquifer wells, and they plan to treat the water for nitrates as needed to increase beneficial use.

The 2006 nitrate monitoring study (cited in the WRD to support the project) shows average nitrate levels in monitoring wells were 10.5 mg/l in 2006. Increased beneficial use of the upper aquifer was a main goal of Resolution 83-13. However, many of the monitoring wells tap the "perched aquifer" (Zone A) and the EIR states the perched aquifer will be significantly adversely impacted by the project. (See Section I.E.2.c.i.)

Further, the EIR estimates the project will potentially reduce average nitrate concentrations in the upper aquifers (Zones B & C) from 10.9 to 8.3 mg/l over 30 years based on the 2003 Yates and Williams study --and the timeframe could 60 years or more because the 2003 study assumed all water removed with the project would be returned, and it assumed a much higher rate of disposal/recharge. (See Cited Document 34, p. 17, Cited Document 38, p. 35, or Cited Document 39, p. 8.) Thus, the LOWWP will not increase the beneficial use of the upper aquifer for the foreseeable future.

The CCRWQCB acknowledges that the benefits of the project are minimal. The CCWQCB Staff Report for the WDR cites an "exceedance of nitrate in some wells," and states that, "Discharge of waste to the waters of the state is a privilege, not a right…" (See Cited Document 27, p. 21.) The WDR also claims that the project is "vital" to meeting pathogen TMDL goals for the Morro Bay National Estuary, but this claim is not accurate (See Section I.E.1.b.i.)

On the other hand, the current wastewater system (with natural treatment in the soil and a high level of rainwater recharge in the basin) reduces nitrate concentrations 75-80% by the time surface water (including septic system discharge) percolates to the shallow aquifers, a few feet below the surface. The Regional Basin Plan nitrate objective is set at the Title 22 standard of 10 mg/l. **Thus, the $190 million project improves the current system by only 5% over 30-60 years and it does not improve the beneficial use of the water.**

Furthermore, the Yates and Williams study shows between 58% and 70% of the nitrate loading in upper aquifer is from sources other than prohibition zone septic systems, with about 25% of nitrate

loading from domestic pets, livestock, irrigated vegetation, weeds, and natural vegetation. (See Cited Document 34, p. 17, Tables 1 & 2, and 10.) Substantial evidence supports that the Regional Basin Plan nitrate objective can be reached in Los Osos with septic system and nitrate management programs since similar programs successfully and rapidly reduced nitrate concentrations in ground and surface waters in the San Lorenzo River Watershed. Moreover, a five percent increase in rainwater percolation is reasonable with a better storm water management program in Los Osos. Percolation of the storm water now draining to the National Estuary and Los Osos Creek, which pollutes these sensitive habitats, would not only reduce nitrate concentrations in the basin but also stop pollution of the estuary and creek, protecting and enhancing these resources. A good storm water management system will not be affordable with the high cost of the LOWWP (See Section I.E.1.c.iii. for further discussion of the benefits of integrated basin-management programs.)

All the water pumped from the upper aquifer could be treated at the well for under $6 million, based on the capital cost estimate for a recent grant application to treat water at the South Bay Well ($600,000). Based on the San Lorenzo Watershed Management Plan, the capital cost for septic system and nitrate management would be under $1 million annually. A conservative estimate for an LID storm water recharge program is under $ 10 million, and a conservative estimate for a conservation program for the basin is $5 million (or less, given the major reduction in water use since 2004 with tiered rate structures). **Thus, for less than $20 million in management programs and measures all the potential project benefits could achieved. In addition, seawater intrusion could be stopped or reversed, pollution of the National Estuary and Los Osos Creek would greatly reduced, and destruction of eight acres of ESHA, the release of 8,000 tons of GHG, and the consumption of 400,000 gallons of fossil fuel would be avoided. Further, a very substantial risk to vital resources including scarce financial resources would be avoided**.

II.C.2. Potential Project Benefits

1. **A reduction in nitrate levels in some shallow and upper aquifer wells (Zones A-C) over 30-60 years.**
2. **A reduction in average nitrate levels in shallow and upper aquifer wells over 30-60 years (from 10.5-10.9 mg/l down to 8.3 mg/l), which represents an improvement of 5% over the current system (see "Overview," Section II.C.1. above.)**

II.C.3 Factors that offset benefits: (See "Overview" above, Sections I.E.1.c., I.E.I.d., and Part IV.D.)

1. The potential reduction in nitrates will not increase the beneficial use of the upper aquifers in the foreseeable future.
2. Purveyors will be treating upper aquifer water for nitrates, and the upper aquifer water supply can be treated for a capital cost of $6 million (1/20th of $190 million project).
3. Nitrate levels in the upper aquifers stabilized in 2006 and could be lower now.

4. The large lower aquifers (9/10ths of basin's capacity) are not contaminated and not likely to be contaminated by septic systems with basin management and more pumping form the upper aquifer.
5. Regional Basin Plan objectives can be achieved with nitrate management, septic system management, conservation, and storm water management similar to the comprehensive watershed management program in the San Lorenzo River Watershed.
6. Improved septic system function/reduced failures can be achieved with septic system management
7. Pollution of the estuary by urban runoff will be stopped/reduced with a storm water management program, which is not affordable with the LOWWP.

II.C.4. Exaggerated/Non-existent Project Benefits (Not accurate/not supported by substantial evidence.) (See Section I.E.1.)

1. **The project does not protect Morro Bay National Estuary and related habitat (ESHA—wetlands and creeks)** (Potential benefits on ESHA are non-existent per available evidence; potential adverse impacts are substantial, including to Los Osos Creek (steelhead habitat.) (See Section I.E.1. for exaggerated benefits and Section I.E.2. unmitigated adverse impacts.)

2. **The project will not significantly benefit/protect the water supply (Los Osos Valley Water Basin, Aquifer Zones A-E)** Long-term, modest potential benefits to the water supply are substantially outweighed by severe potential adverse impacts.) (See Sections I.E.1.c. and I.E.1.d.)

3. **The project is not needed for basin/resource sustainability** A management alternative provides the best chance for basin sustainability because it minimizes risk and adverse impacts, while maximizing benefits, e.g., to seawater intrusion.). (See Section I.E.1.d.)

II.D. Project adverse impacts (potential and unavoidable) are major

II.D.1. Unmitigated Potential Adverse Impacts (See Section I.E.2.)

1. **Groundwater/Water Supply** ***[Reduction in supply--Shallow aquifers (Zones A & B)]*** (Focus of Resolution 83-12)--drops in water tables, salt degradation from recycled water, reduced beneficial use. (See Section I.E.2.c.i.)

2. **Groundwater/Water Supply** ***[Reduction in supply--Upper (production) aquifer (Zone C)]*** (Focus of LOWWP, 1/10th of basin)—drops in water tables, seawater intrusion, salt degradation from disposal, reduced beneficial use. (See Section I.E.2.c.ii and I.E.2.c.iv.)

3. **Groundwater/Water Supply** ***[Reduction in supply--Lower (production) aquifers (Zones D & E)]*** (Main water source 9/10ths of basin)—drops in water tables, increased seawater intrusion, reduced beneficial use (See Sections I.E.2.c.iii and I.E.2.c.iv.)

4. **ESHA** ***[Reduction in size/drying--Sweet Spring, Sweet Spring Marsh, Pecho Road Marsh, Third Street Marsh, Baywood Marsh, Willow Creek Drainage (riparian corridor)]*****—**reductions in freshwater flow, salt/contaminant degradation from recycled water/disposal, impacts to sensitive plant and animal species (e.g., salt marsh bird's beak, California sea-blite, red-legged frog, southwestern pond turtle), and overall habitat diversity. (See Section I.E.2.b. and I.E.2.d.)

5. **ESHA/Surface Water** ***[Reduction in flows/contamination--Morro Bay National Estuary (State Marine Reserve) and Los Osos Creek (endangered steelhead habitat)]***--reductions in freshwater flow, reduction in wetland buffer, salt/nutrient/bacteria degradation from run off, salt/contaminant degradation from recycled water/disposal, impacts to sensitive plant and animal species (e.g., endangered steelhead, salt marsh bird's beak, California sea-blite, red-legged frog, southwestern pond turtle), and overall habitat diversity. Impacts to health and safety, recreational use restrictions. (See Section I.E.2.b. and I.E.2.d.)

6. **Geology/Earthquake** ***[Loss of life and property--liquefaction under homes below Broderson leach fields]*****—**Loss of life, injury, collapse of homes, major infrastructure/property damage. (See Section I.E.2.f.)

7. **Geology/Earthquake** ***[Loss of life and property--collection system damage and catastrophic failure]***—Major displacement of infrastructure (manholes floated/permanently forced up through paved streets), overflows into sensitive surface water, back up into homes, severe threats to health and safety, severe injury, loss of access to home and forced evacuation. (See Section I.E.2.f.)

8. **Cumulative Impacts (ISJ Water Management Plan) Substantially increases adverse impacts to Groundwater, ESHA, Air Quality due to more pumping from the upper aquifer, etc.**--drops in water levels, increased seawater intrusion, loss of basin/aquifers for beneficial use, loss of habitat due to reduced groundwater flows, major impacts to air habitat and quality, especially if supplemental water projects are required. (See Section I.E.2.e.i.)

9. **Cumulative Impacts (Recycled Water Program) Substantially increases adverse impacts to Groundwater, ESHA, Air Quality due to high salts/contaminants, non-viability/non-participation**--drops in aquifer water levels, increased seawater intrusion, loss of beneficial use, loss of habitat due to salt/contaminant degradation or reduced groundwater flows, impacts to ESHA and air quality from pumping or construction for additional facilities (e.g., storage and treatment facilities) or supplemental water projects are required. (See Section I.E.2.e.ii.)

10. **Cumulative Impacts (<u>Septic system decommission/lateral installation</u>) Substantially increases adverse impacts to groundwater, ESHA, air quality/climate change, public health and safety from on-site construction in ESHA (trenching, dewatering, etc.)--**impacts to groundwater, sensitive plant and animal species (e.g., Morro Shoulderband Snail), state and local air quality/climate change (failure to meet goals), injury from construction (trench collapse, etc.). (See Section I.E.2.e.ii.)

11. **Socio-economic Impacts <u>(Project costs-- $170 to $350 per month)</u> Substantially increases potential adverse impacts to Groundwater, ESHA, Air Quality, Health and Safety because makes needed water management/mitigations/repairs unaffordable**--drops in water levels, increased seawater intrusion, loss of basin/aquifers for beneficial use due to unfunded purveyor/basin management measures, impacts to ESHA and health and safety due to unfunded system maintenance/repairs, mitigation measures, storm water management (e.g., surface water contamination), impacts to air quality from construction of supplemental water projects. (See Section I.E.2.d.iii.)

12. **Growth inducement impacts substantially increases adverse impacts to Groundwater, ESHA, Air Quality due to unsustainable pumping from aquifers and unsustainable growth.**--drops in water levels, increased seawater intrusion, loss of basin/aquifers for beneficial use, loss of habitat due to reduced groundwater flows, major impacts to air habitat and quality, especially if supplemental water projects are required. (See Section I.E.2.h.)

<u>II.D.2. Unavoidable adverse impacts (Partial List)</u>

1. **ESHA/Terrestrial habit [<u>Permanent loss of 8.5 acres of ESHA--Broderson site</u> (re-excavated every 7 years)]**

2. **ESHA/Terrestrial habit [<u>Disturbance of 500-1000 acres of sensitive habitat</u> on private property during decommissioning of septic systems and lateral installation.]**—impacts to sensitive plant and animal species, e.g., Morro Shoulderband Snail

3. **Farmland [<u>Permanent loss of 40 acres of prime farmland</u> for treatment site]**

4. **Air Quality/Project Construction *[8,000 tons of GHG emissions during construction of collection, treatment, and recycling facilities]*—**major adverse impacts to local and state air quality, failure to meet AB 32 goals.

5. **Air Quality/Project Operation [<u>6,000 tons of GHG emissions</u> for pumping and facility operations over 30 years]—**major adverse impacts on local and state air quality, failure to meet AB 32 goals. (See Section I.E.2.g.)

6. **Non-renewable/Irretrievable resources [*42 miles of 8" avg. diameter PVC* plus pump *stations and treatment facility;* 400,000 gallons of fossil fuel consumed for three million miles of vehicle trips (the equivalent of six round trips to the moon)]**

7. ****Non-renewable/Irretrievable resources [*30-40 miles of 4" avg. diameter PVC for laterals; 130,000 gallons of fossil fuel consumed for approx. 1 million miles of vehicle trips (on-lot)]****

*****Unavoidable/irretrievable adverse impacts from on-lot construction (decommissioning and lateral installation) may have been included in EIR GHG calculations, but the EIR did not analyze or specifically address environmental impacts. Therefore, the program has unmitigated potential cumulative impacts. (See "Unmitigated Potential Adverse Impacts"* #10 in Section II.D.1. *above.)***

The following DEIR discussion of the "no project" option highlights the considerable adverse impacts of the LOWWP. A comprehensive management alternative (See Section I.E.1.d.iii and Part IV.D.) would also result in avoidance of these adverse impacts, while achieving project goals and maximizing opportunities for resource sustainability (environmental, social, and economic), with none of the potential adverse impacts.

> *If the County implements the No Project/No Action Alternative, the proposed LOWWP wastewater treatment plant, collection and conveyance system, effluent disposal system and biosolids handling facilities would not be constructed and operated. Therefore, the LOWWP would not cause impacts to the project area during the construction or operation phases. Potentially significant impacts related to the permanent losses of habitat for endangered species and Prime Farmland, geologic hazards, public health and safety, traffic and circulation, construction noise, air quality, groundwater resources, visual resources, and cultural resources would not occur. Actions to mitigate these potentially significant impacts to a level that is less than significant would not be required. The impacts to prime farmland that cannot be mitigated and, therefore, are significant and unavoidable, would not occur (See Cited Document 100, p.7-20.)*

II E. Cost-Benefit. Risk, and Project Priority Analyses:

II.E.1. Overview: As this Request shows, the potential benefits of the LOWWP are virtually non-existent, while the unavoidable and potential adverse impacts of the project to the basin, habitat, air quality, and socio-economic resources are major. Even very basic cost-benefit, risk-benefit, and project priority analyses make it abundantly clear the project's tremendous costs and risks relative to project's benefits and need make the LOWWP an extremely poor use of scarce financial resources.

II.E.2 Cost-Benefit Analysis: The following very basic cost benefit analysis illustrates the dramatic difference in benefits versus costs between integrated management and the LOWWP.

Cost-Benefit

Project	Cost	Benefit(s)	Cost/Benefit Ratio
Management	$20 M	Stops seawater intrusion* Reduces pollution of the basin long-term Stops pollution of estuary/LO creek Avoids/minimizes GHG emissions Avoids/minimizes fossil fuel consumption Avoids/minimizes destruction of ESHA Avoids/minimizes potential environmental adverse impacts Avoids social and economic impacts Reduces energy consumption & GHGs	$ 2 M/Benefit
LOWWP	$190 M	Reduces pollution of the basin-long term**	$190 M/Benefit

* The management option provides the best chance of stopping seawater intrusion because it avoids basin disruption and potential adverse impacts, including unmitigated adverse impacts.

** The WDR claims the project will reduce polluted run off entering the estuary from the current storm drain system, but this "benefit" is uncertain and the project will make a good storm water system unaffordable.

II.E.3. The following basic benefit-risk analysis highlights the very high benefit-to-risk ratio of a management alternative compared to the LOWWP

.

Benefit versus Risk

Project	Benefit(s)	Risks	Benefit-Risk Ratio
Management	• Stops seawater intrusion* • Reduces pollution of the basin long-term • Stops pollution of estuary/LO creek • Avoids/minimizes GHG emissions • Avoids/minimizes fossil fuel consumption • Avoids/minimizes destruction of ESHA • Reduces energy consumption & GHGs	• None	7 to 0 = **7**
LOWWP	• Reduces pollution of the basin-long term	• Reduce shallow water source • Reduce upper aquifer water source • Reduce lower aquifer water source • Harm habitat • Harm soils • Loss of life and property • Loss of $190 M *	1 to 7 = **1/7**

* $190 M would be lost if the basin is lost or an earthquake causes major damage requiring re-installation of much of the system.

II.E.4 Project Need Analysis: The Seattle Public Utilities' Asset Management Program prioritizes projects based on need by assigning a point value to the "criticality" of system failure (how devastating the consequences could be if a project is not installed) versus the probability of system failure (the likelihood of system failure if the project is not built). The point values are multiplied together to arrive at a total value, which is used to eliminate/prioritize projects.

Since the LOWWP's basic purpose (need for the project) is to preserve the basin as a viable water source, this method can be applied by comparing the likelihood of basin failure without the LOWWP to the likelihood of basin failure without integrated basin management. The evidence we provide shows that the likelihood of basin failure without the project is non-existent ("0" on a 10-point scale) although the criticality (seriousness) of basin failure is high ("10"). The likelihood of basin failure without basin management is much higher (estimated at "5") with the same level of criticality.

Project Priority Based on Need

Project ranking (comprehensive management versus the LOWWP) is based on the potential for system (basin) failure without the "project."

Project	Threat/Problem	Criticality (seriousness)		Probability (likelihood)	Priority
Management	Seawater	10	X	5	50 points
LOWWP	Nitrates	10	X	0*	0 Points

* This does not factor the threat the LOWWP poses to the basin. The "probability" point value for the LOWWP should be a negative value.

Part III. Property owners adversely affected by the project were not notified and given a chance to comment.

III.A. Overview: The Commission failed to comply with notice provisions [Administrative Regulation 14 CCR § 13105 (b).]

Coastal Commission Administrative Regulation: 14 CCR § 13105 (b) states:

> *Failure to comply with the notice provisions of Section 13054, and could have caused the commission to require additional or different conditions on a permit or deny an application.*

III.B. Several project issues or impacts required notice of property owners outside the prohibition zone.

As the evidence in this Request shows, the LOWWP will have significant potential adverse impacts on properties outside of the prohibition zone. The owners of these properties should have been given a chance to make their views known to the Commission. Potential adverse impacts include: 1) impacts to private wells. (The project has unmitigated adverse impacts on all aquifers in the urban area, including on all properties not in the prohibition zone.) 2) impacts to soils from recycled water use (It is likely property owners outside of the prohibition zone will have to use recycled water as a result of adverse impacts on private wells and/or a County requirement that property owners use recycled water to provide more disposal capacity for the project.), 3) impacts to native vegetation and landscaping on their properties from lower water tables or recycled water, 4) impacts to views from adverse impacts on nearby habitat, trees, or other vegetation, and 5) impacts to home values from any of the above. These significant potential adverse impacts to properties required these homeowners to be notified and given an opportunity to comment on the project. Their comments could have reasonably resulted in the Commission's changing the project or denying it.

All property owners in the Los Osos area should have been notified because the project has severe potential adverse impacts on seawater intrusion and basin sustainability, vital sensitive habitat in the area, and the community's ability to maintain and support sustainable resources. The affected resources are enjoyed and used by everyone in the Los Osos area.

Part IV. The Commission failed to comply with the Coastal Act and CEQA due to inaccurate, erroneous, or incomplete information.

IV.A. The Commission failed to comply with the Coastal Act

As a result of receiving inaccurate, erroneous, and incomplete information, the Commission failed to comply with the Coastal Act and Local Coastal Plan. The approved project is not consistent with the following sections of the Coastal Act and the Local Coastal Plan (LCP) designed to maintain, protect, and restore water basins, ESHA, and air quality, in addition to providing for orderly coastal development: Coastal Act Sections 30001, 3001.5 & 30231; LCP Environmentally Sensitive Habitats Polices 1, 2, 7, & 20; LCP Coastal Watersheds Policies 1, 2, 3 & 5; LCP Public Works Policy 6; CZLUO Sections 23.04.403, 23.07.170-178.

IV.B. The Commission failed to comply with CEQA.

Coastal Commission Administrative Regulation: 14 CCR § 13096 states:

> (a) All decisions of the commission relating to permit applications shall be accompanied by written conclusions about the consistency of the application with… Public Resources Code section 21000 and following, and findings of fact and reasoning supporting the decision. The findings shall include all elements identified in section 13057(c).

This section requires the Commission to address all significant adverse impacts unless the Commission states overriding considerations per CEQA Sections 21000, 21001, 21001.1, 21002, 21002.1, 21080, 21080.5, 21081, 21100, and to deny the project if there are feasible alternatives available that "…substantially lessen the significant environmental effects…" of the project (CEQA Sections 21002 and 21080.5). CEQA further requires findings to be based on "…substantial evidence in the record" and for decisions to be supported by substantial evidence (21081.5, 21168.5.)

As shown in this request, the Commission failed to comply with CEQA as a result of County and CCRWQCB's providing inaccurate, erroneous, or incomplete information in violation of Coastal Commission Administrative Regulation 14 CCR § 13105. The County and CCRWQCB also failed to comply with CEQA and other applicable laws and regulations, including CEQA 21003.1 (b), 21005, and 21168.5 by not providing relevant information "as soon as possible" and/or basing findings on substantial evidence in the record. The County and CCRWQCB further failed to comply with CEQA sections cited in the previous paragraph, e.g., not addressing all adverse impacts and identifying the least harmful feasible alternative. (See further discussion of CEQA violations in Section I.E.2.j.)

IV.C. Overriding considerations are not justified.

CEQA Section 21081 allows agencies to approve a project with unmitigated adverse impacts or adverse impacts that outweigh benefits--or to approve projects that are not the least harmful feasible alternative--if the agency finds that overriding considerations justify the project. In the case of the LOWWP, overriding considerations are not justified. The following are some potential overriding considerations and why they are not justified: *1) The project is required per an order by the CCRWQCB (Resolution 83-13).* This does not justify the project because the Resolution is not supported by substantial evidence in the record (i.e., the science and findings used to justify approval of the Resolution 83-12 have been refuted or no longer apply). *2) A tremendous amount of money has been spent on this project.* This is not a justification because much more money will be spent, with severe known and potential adverse impacts to vital environmental, social, and economic resources including funding. 2) *Funding will be lost*. Funding agencies can redirect funding to a more cost-effective alternative. 3) *The project's long-term benefits justify its short-term impacts.* This conclusion is not supported by evidence, which shows the project's adverse impacts outweigh its potential long-term benefits. 4) *Agencies will be harmed due to potential liability.* This does not justify the project that jeopardizes a water basin, environmentally sensitive resources of state and national significance, public health and safety, and the ability of a community to protect, maintain, and preserve vital resources.

IV.D. A much less harmful feasible alternatives exist

IV.D.1. Overview: A comprehensive management alternative, in lieu of the project, is a much less harmful feasible alternative. The alternative would include basin wide integrated septic system management, nitrate management, storm water management, and conservation programs, and it would be organized and administered similar to the San Lorenzo River Watershed Program in Santa Crus County. Current conditions (e.g., accelerating seawater intrusion with nitrate levels stabilized and purveyors planning to treat the upper aquifer for nitrates) make this the least harmful, feasible alternative. The LOWWP is not needed and only jeopardizes resources. The management alternative achieves the water quality objective of the project, while providing other substantial environmental benefits (e.g., stops pollution of the estuary from run off and reduces community energy use). A management alternative also avoids the considerable known and potential adverse impacts of the LOWWP (including the loss of eight acres of ESHA, 8,000 tons of GHGs, 400,000 gallons of fossil fuel consumption, and the excavation of 40 miles of city streets). It further maximizes benefits to resources by prioritizing seawater intrusion mitigation in the short-term and contaminant management over the long term, balancing water quality and supply goals. It further maximizes funding while minimizing the risk to funding. Thus, the management alternative provides the best chance for basin and resource sustainability (environmental, social, and economic).

Below is a partial list of benefits: (Also see Section II.C, e.g., II.E.2. "Cost Benefit Analysis".)

1. **Avoids adverse environmental impacts--maintains and/or restores ESHA and farmland and avoids impacts on seawater intrusion, cumulative and socio-economic impacts, earthquake impacts, health and safety impacts, air quality/climate change impacts, and impacts on non-renewable resources.**
2. **Stops or reverse seawater intrusion in several ways:** 1) maximizes conservation 2) maximizes storm water recharge, 3) focuses resources and basin planning on the problem, 4) allows purveyors to focus resources on the problem, 5) involves other agencies in the effort
3. **Substantially reduces pollution of the estuary with a comprehensive, effective, affordable storm water program/system.**
4. **Reduces nitrates in the groundwater in at least four ways:** 1) with a septic management program (including phased septic system upgrades—as needed), 2) with a salt and nutrient (nitrate) management program, 3) with storm water management (including basin recharge which dilutes groundwater contaminants), and 4) comprehensive conservation (which reduces the rate of septic system discharge and increases natural soil treatment).
5. **Is much less costly, avoiding socio-economic impacts.** A reasonable estimate for a comprehensive program is under $20 million (under $4 million for basin-wide septic system and nitrate and management programs, under $10 million for a storm water management system, and under $6 million for water use efficiency programs. This is about one-tenth of the total project cost, allowing homeowners to pay for necessary water management measures that purveyors will be implementing (nitrate treatment, well-relocation, and shifts in pumping). It also makes it possible for homeowners to pay for programs to protect, preserve, and restore vital habitat (e.g., Los Osos Creek) and to repair infrastructure if/when natural disasters such as earthquakes strike**.**

   For other less harmful feasible alternatives also see Attachment 8 (and supporting documentation Cited Documents 86 & 87, also see Citizens for a Sustainable Community (CSC) CEQA/NEPA comments/objections to the CCWQCB and SWRCB submitted by Angel Law --(See Cited Document 25, Cited Document 49 and Exhibits (exhibits are on disc.)

**** The LOSG incorporates by reference the violations of CEQA/NEPA cited in the above-referenced (and attached) Angel Law objection/comment letters and addenda submitted to the CCRWQCB and SWRCB --as they apply to Coastal Commission review and approval of the LOWWP.** [See Cited Document 25, Cited Document 49 and Exhibits (Exhibits are on disc), and Cited Document 50.]

IV.E. Final Note: Los Osos citizens have done due diligence and should not have to file a costly lawsuit.

The LOSG and members of the Los Osos public have had to assume the role of the County, Water Boards, and other agencies in identifying and disclosing the potential adverse impacts of this project and the benefits of less environmentally damaging alternatives. The LOSG alerted authorities to the potential of accelerating seawater intrusion in 2009, to the fact that the EIR overlooked severe adverse impacts to sensitive habitat, and to the potential for the project to cause seawater intrusion in the upper aquifer. The LOSG has also had to hire experts several times to ensure adverse impacts and alternatives are not overlooked or dismissed. With the help of Angel Law, the Citizens for a Sustainable Community (CSC) first brought to light the considerable unmitigated cumulative and socio-economic adverse impacts of the project.

The County, Water Boards, and other agencies have put an unreasonable burden on the public to identify impacts and alternatives, which they have intentionally failed to disclose. Citizens should not have to do agency work, and then pay to wage a costly legal battle against public agencies, effectively paying two to three times for adequate environmental review and the protection of resources the agencies are charged with protecting.

As citizens of Los Osos living within the prohibition zone, we and our neighbors have also been subjected to an official misinformation campaign and threats of CCRWQCB enforcement actions which have prevented normal agency, organization, and citizen participation, advocacy, and/or oversight in the review process. This has led to a unique condition in which very high value resources are vulnerable to harm by the very agencies charged with protecting them.

Los Osos Citizens further face very high costs for water in the future, resulting from the long-term neglect and mismanagement of the water supply because agencies have put all management efforts on hold pending development of an extremely costly and unpopular centralized sewer pursuant to Resolution 83-13 for 87% of the community. These potential costs include the cost of imported water or desalinated water if the basin fails, as a result of adverse project impacts or continued agency and purveyor neglect and mismanagement of the resource. For this reason, also, citizens should not have to file a costly lawsuit.

Therefore, we request that the Commission stop this destructive project and work with other agencies to development and implement a comprehensive management program for the area at 1/10th the cost of the LOWWP, overseeing the management effort until threatened, neglected, and irreplaceable resources in the Los Osos area are restored and sustainable.

Request for Revocation of the Los Osos Wastewater Project (LOWWP) Coastal Development Permit (CDP)

Los Osos Sustainability Group (LOSG), February 20, 2012

Grounds for Revocation

(Outline)

I. Agencies intentionally provided the Commission inaccurate and incomplete information that would have required additional or different conditions or denial of the permit

I.A. Violation overview: The County and CCRWQCB violated Coastal Commission Administration Regulation 14 CCR § 13105 (a)
I.B. Flawed findings in the Staff Report of May 27, 2010, based on inaccurate, erroneous, or incomplete information.

I.B.1. Flawed findings in the CDP Staff Report of May 27, 2010
I.B.2. *S*tatements by Jonna D. Engel, Ph.D., Commission Ecologist (Memorandum dated May 19, 2010)

I.C. Evidence the Commission cites to support flawed findings based on Inaccurate, erroneous or incomplete information provided by the County and CCRWQCB.

I.C.1. Overview
I.C.2. Evidence in the Staff Report of May 27, 2010

I.D. Additional inaccurate, erroneous or incomplete information the County and CCRWQCB provided to the Commission.

I.D.1. Overview
I.D.2. Statements by County Supervisor Bruce Gibson at the January 2010 Coastal Commission hearing.
I.D.3. Statements by Roger Briggs, Executive Officer of the CCRWQCB, in a letter to the Commission.

I.D.4. Statements by Jonathon Bishop at the June 2010 hearing.

I.D.5. Evidence provided in other sections of this Request show that inaccurate, erroneous, or incomplete information intentionally provided by the County and CCRWQCB led to Commission's approval of a project with severe unmitigated impacts

I.E. Accurate and complete information agencies intentionally withheld.

I.E.1. Evidence that septic systems do not threaten Morro Bay National Estuary, related habitat, the basin, or public health and safety—and the project is not needed for basin sustainability, (A comprehensive management plan would achieve project goals and basin sustainability with far fewer impacts and risks for a fraction of the cost).

I.E.1.a. The EIR does not state or show that the project will benefit the estuary, is essential for basin sustainability, or is critically necessary to protect public health and safety.

I.E.1.b. Pathogens from septic systems do not threaten the estuary, public health, or the basin—but pathogens from the LOWWP will threaten these resources.

I.E.1.b.i. The 2002 Kitts DNA study confirms septic systems do not threaten the estuary, related habitat, or public health, and a community wastewater project will not benefit these resources.

I.E.1.b.ii. Failing/flooding septic systems are no longer reported in the community; to the extent the potential remains, it is best addressed with an improved storm water management system, which is unaffordable with the LOWWP.

I.E.1.b.iii. The absence of coliform bacteria from septic systems in shallow test wells shows septic systems are functioning property and not polluting the estuary.

I.E.1.b.iv. The absence of any documented adverse health effects from septic systems in over 40 years proves septic systems are not a threat.

I.E.1.b.v. The LOWWP will not stop pathogen pollution of the estuary, and it poses a greater threat to the estuary and public health (e.g., from overflows).

I.E.1.c. I.E.1.c. Nitrates and other contaminants from septic systems in Los Osos do not threaten the estuary, public health, or basin sustainability. (However, the

project makes basin sustainability less likely and can raise contaminant levels in the estuary and creeks causing harm to these systems.)

I.E.1.c.i Despite statements by County Supervisor Bruce Gibson, nitrates from the upper aquifer do not adversely impact the estuary or related habitat.

I.E.1.c.ii Nitrate pollution of the estuary and related habitat is from runoff, not septic systems, according to the WDR and SLOSEA data.

I.E.1.c.iii. Nitrate levels had stabilized in the upper aquifer by June 2010, evidence showed the project would not increase the beneficial use of the water in the foreseeable future, and programs and measures that could increase beneficial use and reduce nitrates (achieve project objectives) were available.

I.E.1.c.iv. The potential for contaminants from the upper aquifer to pollute lower aquifers is insignificant and best addressed with management measures and planned pumping changes.

I.E.1.c.v. Emerging contaminants found in some upper aquifer wells do not threaten health and safety, and a wastewater project will add emerging contaminants to the water supply.

I.E.1.d. Despite official claims that the basin is not sustainable without a wastewater project, evidence supports that current conditions are sustainable--except for seawater intrusion. Sensitive habitat is thriving under present conditions (and the project will adversely impact habitat), while comprehensive management provides the best opportunity for resource sustainability.

I.E.1.d.i. Sensitive habitat, including Morro Bay National Estuary, is sustainable and thriving under current conditions.

I.E.1.d.ii. Purveyors plan to treat for the upper aquifer for nitrates, as needed, which increases the beneficial use of the aquifer; nitrate treatment and management increases the beneficial use of the upper aquifer for less than 1/20th of the project cost.

I.E.1.d.iii. Comprehensive basin-wide/watershed management—with integrated septic system, salt and nutrient (nitrate), storm water management (LID/basin recharge), and conservation, (including greywater reuse and rainwater harvesting)—without the project--provides the best chance of stopping seawater intrusion and achieving basin/area sustainability.

I.E.2. Evidence that the project will cause severe unmitigated adverse environmental impacts on the basin, Morro Bay National Estuary and related

environmentally sensitive, public health and safety, and air quality/climate change.

I.E.2.a. Overview: The Commission's failure to mitigate resulted from inaccurate, erroneous, or incomplete information provided by agencies.

I.E.2.a.i. The project EIR ignores and understates severe potential impacts on vital resources, which County and CCRWQCB intentionally withheld.

I.E.2.a ii. The County Planning Commission unsuccessfully attempted to mitigate for the project by adding 110 conditions to the CDP.

I.E.2.a.iii. The County's response to Commission Staff questions regarding substantial issues provided inaccurate and incomplete information resulting in severe unmitigated project impacts.

I.E.2.a.iv. The final CDP (e.g., Special Condition 5 "The Los Osos Basin Groundwater Management Plan") fails to mitigate for adverse impacts, responding to inaccurate/incomplete information regarding project impacts and benefits.

I.E.2.a.v. The final CDP fails to mitigate for ground water impacts and to protect resources, responding to inaccurate/incomplete information regarding project funding.

I.E.2.b. The project will have severe adverse impacts on Morro Bay National Estuary and related habitat, including Los Osos Creek, endangered steelhead habitat.

I.E.2.b.i. The project will cut off groundwater flows to sensitive habitat, potentially reduce the size, viability of wetlands, and could reduce flows in Los Osos Creek, steelhead habitat.

I.E.2.b.ii. Drying of wetlands will harm the National Estuary and Los Osos Creek by causing pollutant levels to rise

I.E.2.c. The project will have severe adverse impacts on the basin water supply, substantially reducing chances for basin sustainability, and defeating a major purpose for the project as stated in Resolution 83-13, to increase the beneficial use.

I.E.2.c.i. The project will adversely impact the shallow water supply.

I.E.2.c.ii. The project will adversely impact the upper aquifer community water supply.

I.E.2.c.iii. The project will adversely affect the lower aquifer community water supply.

I.E.2.c.iv. Broderson leach field disposal, the main groundwater mitigation measure, fails to mitigate for impacts on the basin or habitat and could be infeasible.

I.E.2.d. The Draft Recycled Water Management Plan (RWMP), which the County prepared to comply with CDP Special Condition 5 (a-d), fails to mitigate for the project and provides further evidence that mitigation is not feasible.

I.E.2.d.i Overview.

I.E.2.d.ii The "Recycled Water Reuse Program" of the RWMP does not mitigate for the project's impacts on seawater intrusion or habitat.

I.E.2.d.*iii *The RWMP "Conservation" program does not mitigate for project impacts on seawater intrusion and habitat.

I.E.2.d.iv The RWMP "Monitoring Program" does not ensure impacts are mitigated or measures are feasible.

I.E.2.d.v. The RWMP "Reporting and Adaptive Management" program does not mitigate for impacts on seawater intrusion and sensitive habitat, and shows mitigation is infeasible.

I.E.2.e. The project will have severe indirect, cumulative, and socio-economic impacts, not addressed or mitigated, which could lead to severe (even catastrophic) environmental impacts.

I.E.2.e.i. The project in conjunction with the purveyor (ISJ) "Basin Plan" and management measures will have indirect and/or cumulative adverse impacts on the basin, sensitive habitat, and human health and safety. (The project is most likely already having indirect adverse impacts by delaying purveyor management measures needed to stop seawater intrusion, e.g., pumping shifts to the upper aquifer.)

I.E.2.e.ii. The Recycled Water Management program, conservation program, adaptive management program, storm water management program, and sewer hook-up program (including septic system decommissioning) will have significant indirect and/or cumulative adverse impacts.

I.E.2.d. iii. Project socio-economic impacts will have severe—even catastrophic--adverse impacts on the environment. T

I.E.2.f. The project will have severe adverse impacts due to earthquakes.

I.E.2.f.i **Overview**.

I.E.2.f.ii The project fails to mitigate for adverse earthquake impacts from the collection system on the environment and human health and safety.

I.E.2.f.iii The project fails to mitigate for adverse earthquake impacts on homes downhill from the Broderson site.

I.E.2.g. The project will have severe adverse impacts due to GHG emissions.
I.E.2.h. The project will have severe adverse impacts due to growth inducement.
I.E.2.i. The project will have severe adverse impacts due to the failure of the County, CCRWQCB, and SWRCB to commit to project mitigation.

***I.E.2.i.i* The County has shown a failure to commit to project mitigation and basin sustainability**

***I.E.2.i.ii* The CCRWQCB has shown a failure to commit to project mitigation and basin sustainability.**

TABLES for Part I

I.E.2.j. Table A: Unmitigated groundwater Impacts and why conditions do not mitigate.
Table B: Other unmitigated impacts and why conditions do not mitigate.
Table 1: Conservative Estimate of LOWWP Adverse Impacts on the Upper Aquifer with Purveyor Shifts in Pumping by 2015.
Table 2: Conservative Estimate of LOWWP Adverse Impacts on the Perched Aquifer and Shallow Groundwater Flows to ESHA by 2015

I.E.3 Evidence that various documents and statements used to support the project are inaccurate, erroneous, or incomplete—and do not justify the project.

I.E.3.a. Resolution 83-13 is obsolete and should does not justify the project.

I.E.3.a.i Overview.

***I.E.3.a.ii* Most of the key findings in Resolution 83-13 have been refuted or no longer apply.**

I.E.3.a.iii The Resolution environmental documentation required for CEQA compliance highlights why the Resolution does not justify the project and should not have been used to guide it.

I.E.3.b. AB 2701 does not justify the project because it is based on the inaccurate finding that the project is urgently needed to protect health and safety .
I.E.3.c. A recent Superior Court decision does not justify the project because it is based on inaccurate, erroneous, and incomplete information (i.e., is not based on substantial evidence.)

I.E.3.d. Successful Proposition 218 and Rates and Charges assessments do not justify the project

I.E.3.e. The CCRWQCB WDR and Staff Report do not justify the project (and confirm that the project is not justified).

I.E.3.f. The CCRWQCB and SWRCB's rejection of the Citizens for a Sustainable Community (CSC) and LOSG's requests for an SEIR do not justify the project.

I.E.3.g. ISJ Working Group support does not justify the project nor ensure the project will do more good than harm.

I.E.3.h. The Environmental Assessment (EA) that the County submitted to the USDA shows the County's intent to misrepresent project benefits, adverse impacts, and alternatives.

I.E.3.i. A statement by Gordon Hensley, LOCSD Director in 2005, suggests a reason the County and CCRWQCB inaccurately claimed the LOWWP would provide significant benefit to the National Estuary--to obtain federal funding.

II. The project's adverse impacts and risks far outweigh its benefits.

II.A. Overview

II.B. Seawater intrusion poses real threat to basin sustainability--and the project is likely to make it worse.

II.C. Potential project benefits are non-existent when offsetting factors are considered.

II.C.1. Overview

II.C.2. Potential Project Benefits

II.C.3 Factors that offset benefits

II.C.4.Exaggerated/Non-existent Project Benefits (Not accurate/not supported by substantial evidence.)

II.D. Project impacts (potential and unavoidable) are substantial.

II.D.1. Unmitigated Potential Adverse Impacts

II.D.2. Unavoidable adverse impacts (Partial List)

II E. Cost-Benefit. Risk, and Project Priority Analyses: Even basic risk-benefit and cost-benefit analyses make it clear the project is an unwise use of resources.

II.E.1. Overview

II.E.2 Cost-Benefit Analysis
II.E.3. Benefit vs. Risk Analysis
II.E.4 Project Need Analysis:

III. Property owners adversely affected by the project were not notified and given a chance to comment.

III A. Overview: The Commission to comply with notice provisions (Violation of Administrative Regulation 14 CCR § 13105 (b)].

III.B. Several project issues or impacts required notice of property owners outside the prohibition zone.

IV. The Commission failed to comply with the Coastal Act and CEQA due to inaccurate, erroneous, or incomplete information.

IV.A. The Commission failed to comply with the Coastal Act

IV.B. The Commission failed to comply with CEQA

IV.C. Overriding considerations are not justified.

IV.D. A much less harmful feasible alternatives exist

IV.E. Final Note: Los Osos citizens have done due diligence and should not have to file a costly lawsuit.

May 7, 2012
California Coastal Commission
San Francisco, CA

Subject: Los Osos Wastewater Project (LOWWP) Request for Revocation: Fundamental Issues to Resolve, Further Unmitigated and Undisclosed Impacts, Concerns Over Process, and Request to Prevent the County from Taking Irreversible Actions.

Honorable Commissioners:

We are contacting you to re-emphasize the critical need for the Coastal Commission to resolve the fundamental issues we raise in our Request for Revocation, in order to protect and preserve vital coastal resources in the Los Osos area. We are also reporting, and wish to include in the Request, new and additional unmitigated, undisclosed adverse impacts resulting from the LOWWP dewatering program, Broderson leach field disposal, and drainage upgrades. We are writing, also, to voice concerns over the Request for Revocation process and to ask for related information. Finally, we are requesting that the Commission does not approve final project plans or extend the CDP until the Request for Revocation is heard and issues fully resolved, taking all necessary actions to ensure the project does not result in irrevocable impacts or costs prior to the resolution of issues.

Fundamental Issues That Must Be Resolved

To resolve the issues we raise in the Request and to protect and preserve coastal resources in the Los Osos area, the Commission, County, and CCRWQCB must prove the following.

1. The project provides significant and measurable benefits to Morro Bay National Estuary and related habitat.
2. The project provides significant and measurable benefits to the Los Osos water basin, the sole source of water for the area.
3. Another alternative does not provide the same or greater benefits with substantially fewer impacts and risks (i.e., a less harmful, feasible alternative is not available).

The Staff Report of May 27, 2010, on which the Commission based approval of the LOWWP CDP, found that the project is "critically necessary" for the protection and sustainability of the Los Osos Valley Water Basin, Morro Bay National Estuary, and public health and safety—and it is the least harmful feasible alternative. This finding was based on County and CCRWQCB documents and official statements. We provide evidence showing the project does not provide significant benefits to the estuary or basin and could do more harm than good to these resources, severe potential impacts are not mitigated, mitigation for groundwater and ESHA impacts are not feasible, and officials were aware that the information they provided was inaccurate, erroneous, and/or incomplete.

To resolve these issues and prove #1-#3 above requires proving with conclusive scientific evidence 1) that septic systems significantly pollute Morro Bay National Estuary and related habitat (e.g., with pathogens and/or nitrates), and the project will stop the "pollution and threat," 2) the project's potential adverse impacts on the basin (seawater intrusion) and habitat, including earthquake, cumulative, and socio-economic impacts, can be completely avoided with specific, measurable,

enforceable, and feasible measures, 3) the extremely urgent seawater intrusion problem can be stopped (so the $190 million project does not make an alternative water supply economically infeasible--assuming it is technically feasible), and 4) alternatives including a comprehensive management program, which optimizes the current system with septic system, nitrate, and storm water management, in addition to conservation and treatment of nitrates at the well, does not achieve the same or greater benefits with virtually none of the LOWWP's risks or impacts at a fraction of the LOWWP cost, providing the best—possibly the only—chance for basin sustainability and preservation of vital coastal resources. These issues must be resolved to protect and preserve costal resources in the Los Osos area.

Serious Unmitigated, Undisclosed Impacts That Must Be Addressed

1. **Impacts on groundwater (seawater intrusion and ESHA) from inadequate conservation to maintain groundwater levels/flows.** Conservation was intended to provide back up for Broderson leach fields and redundant groundwater impact mitigation to address uncertainties, but the potential is only 1/4th or so of what the County reported in 2010. Further, the community reduced water use by 25-30% as seawater accelerated by 12 times, supporting that project impacts on seawater intrusion cannot be mitigated.
2. **Impacts on groundwater (seawater intrusion and ESHA) from inadequate recycled water use to maintain groundwater levels/flows.** Recycled water use was intended to offset potable use to reduce pumping and maintain water levels, also to provide back up for Broderson leach field disposal, and water to replace flows to ESHA, but it will only offset about 42 AFY of potable water use in the urban area (where pumping must be reduced to mitigate for seawater intrusion) and it doesn't provide enough water to replace flows to ESHA. Most recycled water will be used in agricultural areas, which provides almost no mitigation for seawater intrusion. Further, the program is likely to be under used due to high salt content due to seawater intrusion (i.e., higher salts in the domestic supply means higher salts in recycled water).
3. **Impacts on groundwater, ESHA, and air quality from the dewatering program. (See below for further discussion.)** Dewatering will remove and relocate 2000 to 8000 acre feet from the shallow aquifers of the basin. This will have substantial adverse potential impacts on seawater intrusion and ESHA by reducing/stopping recharge of the basin and groundwater flows (e.g., to wetlands and Los Osos Creek). It could also have adverse impacts on groundwater quality, soils (e.g., liquefaction at the disposal sites), and air quality/GHGs (due to electrical or generator use for pumping). If it is not feasible to pump the water to disposal, it might have to be disposed in the National Estuary or Los Osos Creek impacting these resources.
4. **Impacts on Los Osos Creek and other ESHA.** The project provides no specific, feasible measures to replace the water to these resources although CDP Condition 20 for the prior project identified significant potential adverse impacts to these resources. That project provided multiple leach fields and harvest wells to mitigate for impacts. This project does not include these measures and does not provide enough recycled water to replace flows.
5. **Impacts on the environment, life, and property from earthquakes (See below for further discussion.**) The project has not been mitigated for impacts that would result from collection system damage or potential harm to life and property from Broderson leach field disposal

(including liquefaction of soils). The 2004 Fugro West, Inc. *Geotechnical Report* says that harvest wells will be used to maintain water levels below 20 feet of the ground surface to avoid liquefaction impacts. (See Page 5-10, attached.) As discussed, the LOWWP does not include harvest wells.

6. **Cumulative impacts on resources.** The cumulative impacts of the LOWWP have not been evaluated or mitigated, including impacts from all project programs (e.g., recycling, dewatering, conservation, and habitat rehabilitation) in combination with 1) lateral hook up and septic system decommissioning, 2) purveyor water management measures (e.g., project's adverse impacts on the upper aquifer will preclude necessary purveyor shifts in pumping to the upper aquifer to address the urgent seawater intrusion problem), and 3) the proposed drainage/storm water management program. (See further discussion below.)
7. **Socio-economic impacts on resources**. The socio-economic impacts on resources have not been analyzed and mitigated, including impacts from high project costs that preclude adaptive mitigation measures (to mitigate for seawater intrusion and ESHA), earthquake repairs, rising water costs, future road maintenance/repair costs, future storm water/drainage costs (see discussion below), and a poor economy.

These are some of the significant adverse impacts that the County and CCRWQCB did not disclose or mitigate although evidence shows agency officials were aware of them. The seriousness of the impacts and lack of feasible mitigation measures support a conclusion that the project cannot be mitigated and will do more harm than good. These impacts and other issues raised in the revocation request must be resolved to protect coastal resources.

Serious Unmitigated, Undisclosed Impacts Resulting from the Dewatering Plan

The County recently released a preliminary design for the project's collection system, including the "Appendix D Dewatering Plan" (see http://www.slocounty.ca.gov/PW/Design_Division/Projects_Out_To_Bid/Projects_Out_To_Bid_-_300448_08_01_BC.htm). This plan apparently shows that the project will result in the removal and relocation of several thousand acre feet of water from shallow aquifers to allow the gravity collection system to be installed. The removal of this large amount of groundwater (1/3rd or more of the total recharge of the upper aquifer) will undoubtedly cause significant adverse impacts on the upper aquifer and lower aquifers, as well as EHSA by substantially reducing basin recharge, lowering water tables, and reducing groundwater flows. Thus, dewatering could make the critical seawater intrusion problem worse in the lower aquifer and cause seawater intrusion in the upper, said to be only "relatively stable" in the DEIR. The plan proposes that numerous pumps are installed along at least 35,000 feet of the pipeline route through the community, and it proposes that groundwater is continuously pumped or hauled to the Tri-W site, to Broderson leach fields, or a few drain basins in the community. If that is not feasible for any reason, the water could be disposed in the National Estuary or other ESHA. Therefore, besides adverse impacts on the basin, dewatering could have significant adverse impacts on ESHA (including the National Estuary), groundwater quality, air quality (GHGs), noise levels, and soils (e.g., due to liquefaction). Neither the County nor CCRWQCB had disclosed or addressed these potential impacts during project review although the agencies were clearly aware of them based on the previous project

and basin studies showing high-groundwater areas. **We've submitted a Public Records Act Request to the County asking for more information on this plan and the potential impacts, and we are adding potential impacts from the "Dewatering Plan" to the list of severe unmitigated and undisclosed project impacts to be addressed with our Request for Revocation.**

Serious Unmitigated, Undisclosed (Earthquake-Related) Impacts Resulting from Broderson Leach Field Disposal

In our Request for Revocation we point out unmitigated earthquake-related impacts (environmental and health and safety impacts) resulting from 1) a failure to mitigate for impacts on the collection system (i.e., providing for only a geotechnical report and emergency response plan, ERP), and 2) increased risk of liquefaction from Broderson leach field disposal (saturation of soil under homes downhill from the site). We further point out in the Request that the *Preliminary Geotechnical Report* prepared by Fugro West, Inc. (May 21, 2008, Appendix Q.7 of the EIR), on which the EIR relies to arrive at a finding of no significant impact, is not a valid document, It is labeled: "Draft—Do Not Rely On This Document" so in reality, there is not even a geotechnical report for this project. Regarding Broderson leach field impacts, we wish to further point out—and add to the issues in our Request—that Broderson leach field disposal has unmitigated, undisclosed impacts resulting from 1) the lack of feasible measures to lower groundwater levels to below 20 feet downslope from the site, 2) the saturation of soil under the site, and 3) slope instability issues. The EIR finding that Broderson leach field disposal has low potential to cause liquefaction (and does not significantly increase adverse impacts from earthquakes) relies on the final Fugro West, Inc., March 2, 2004, *Geotechnical Report* for the prior Los Osos wastewater project. The report indicates that groundwater levels will not be allowed to rise above 20 feet, adding that "harvest wells will be used to limit mounding in areas where the groundwater is already relatively shallow north of Los Osos Valley Road" (See Page 5-10, attached). However, the LOWWP does not include harvest wells; they were found to be infeasible. Although the current project includes monitoring wells, monitoring is not mitigation and it does not prevent water from rising above 20 feet. If higher groundwater is discovered, cutting back disposal would not lower groundwater levels right away, and reducing levels could take many years, resulting in significantly increased liquefaction (earthquake-related) risk to life and property. Furthermore, liquefaction can occur under the site due to saturated soils in Horizon A, potentially impacting homes downslope. We also see no evidence that slope stability analyses of the Broderson site/leachfields have been performed, although one is clearly needed due to the nature of the site. The only slope stability analyses presented in the geotechnical reports were for retaining walls and basin slopes. (Please note that experts disagree on the percolation rates at the Broderson site (potential for soils to become saturated and liquefiable) and the potential for effluent to move laterally off site rather than percolate, yet the County has no feasible alternative for Broderson leach fields for seawater mitigation or effluent disposal.) County and CCRWQCB officials are aware of these issues because the site has been controversial and remains controversial. However, officials did not disclose the issues to the Commission. **We are very concerned—and we believe the Commission should be --that potential earthquake impacts have not been fully analyzed, disclosed, and mitigated. We have submitted a Public Records Act Request (PRA) to the County for more**

information regarding earthquake impacts. (We will forward a copy of this and other PRAs we send to the County.

Serious Unmitigated, Undisclosed Impacts Resulting from Drainage Upgrades

The County is planning limited drainage upgrades as part of the LOWWP. The "upgrades" will be funded with $2.2 million originally earmarked for deferred road repairs in Los Osos. (The County has deferred repairs for several years pending completion of the LOWWP.) The plan apparently includes "upgrades" at about 27 sites. Nine of the upgrades appear to be simply maintenance, three involve storm drain or gutter improvements, and about 15 involve "infiltrator" installments (with seven of these also involving swales). A recent report to the LOCSD and Los Osos Community Advisory Council (LOCAC) states that these upgrades have been "environmentally cleared." (See Page 3 of Los Osos CSD Letter, attached.) However, the upgrades require further environmental review. We believe the "infiltrators" could pollute the groundwater with contaminants from run off and/or become clogged in Los Osos sandy soils resulting in a waste of limited resources. As indicated in our Request, the high cost of the LOWWP makes a well-thought-out, community-wide, low impact development (LID) program unaffordable. The report to the LOCSD and LOCAC indicates that a complete program would costs $41 million based on a 1997 drainage management plan. We believe an effective LID program would be substantially less, based on a *Drainage Feasibility Study* completed in 2001 and our own research (cited in our Request), but we still believe the LOWWP makes an effective program unaffordable. Since an effective storm water management plan is needed in Los Osos to reduce pollution from surface run off of the estuary and Los Osos Creek, a comprehensive storm water management program for the community should have been analyzed for its potential cumulative impacts, with mitigations and alternatives analyzed—but it was not. Adding these "upgrades" on to the project at this late date precludes careful planning and review. A well-designed LID system would stop pollution of the estuary from surface run off, recharge the groundwater with clean rainwater, reduce nitrate concentrations in the groundwater through dilution, help maintain flows to habitat, and provide community enhancements with multiple benefits (beautification, landscaping, recreational opportunities, conservation, and storm water recharge). The poorly-thought-out upgrades are likely to only pollute the groundwater and waste money. **We are submitting a Public Records Act Request to the County for more information about the environmental impacts and costs of the upgrades.**

Concerns Over Process and Communication

County officials announced at an SLO County Board of Supervisors' meeting on April 24, 2012, that the Request for Revocation is scheduled for a Coastal Commission hearing in June and they indicated they are working closely with the Commission to resolve Request issues. On the other hand, we have received no communication regarding possible hearing dates and were recently told by Daniel Robinson the date is not "definitive." We were further told that Coastal Commission Staff would not be talking to the County during the review process. We have contacted the Central Coast office several times requesting a description of the process, timelines, and any information the County or CCRWQCB has provided the Commission—but received only two brief responses not providing the information. **These events raise our concerns about the objectivity of the process. We are again requesting all**

information the County or CCRWQCB has provided the Commission, timelines, and clarification of the process. We are also requesting to meet with Staff to discuss Revocation issues.

The Coastal Commission Must Not Allow the County to Take Irreversible Actions Prior to Resolution of the Request Issues

The County continues to move rapidly forward with the project, committing large sums of funding and making decisions that will be very difficult and costly to reverse later (e.g., preliminary design for the treatment plant and requests for proposals for construction of the collection system). The issues we raise are fundamental to whether the project should be built and to reducing harm from the project if it is built (i.e., possible permit denial and/or changed conditions). **Therefore, we request that the Coastal Commission does not approve final project plans or extend the CDP, and takes all necessary actions to ensure the County does not expend further resources or take irreversible actions, until Request issues are resolved.**

Conclusion

Finally, we implore the Coastal Commission to make the sustainability of the Los Osos Valley Water Basin its top priority in decision making. The LOWWP is supposed to preserve the sole source of water for Los Osos, but the current project could destroy the basin and severely harm ESHA, while placing an extreme financial hardship on property owners. Thus, it could not only waste $190 million but cause an environmental, social, and economic disaster in the area. Seawater intrusion poses a critically urgent and real threat to the basin. Elevated nitrate at some wells, the focus of the LOWWP, poses no threat to resource sustainability. Scare economic resources—especially in this poor economy--must be directed at the most cost-effective solution for the critical seawater intrusion problem within a timeframe that maximizes the potential for the basin sustainability. The LOWWP only threatens basin sustainability and the vital coastal resources that depend on it.

Sincerely,

LOSG

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Staff report prepared:	5/27/2010
Staff report prepared by:	Jonathan Bishop
Staff report approved by:	Dan Carl
Hearing date:	6/10/2010

COASTAL DEVELOPMENT PERMIT APPLICATION

Application number.....**A-3-SLO-09-055/069, Los Osos Wastewater Project (LOWWP)**

Applicant.....San Luis Obispo County Public Works Department

Project description.....Construction and operation of a community sewer system, including a treatment plant, collection/disposal/reuse facilities, and all associated development and infrastructure.

Project location .....The unincorporated coastal community of Los Osos adjacent to Morro Bay in central San Luis Obispo County (with the treatment plant located at 2198 Los Osos Valley Road and other related infrastructure located throughout Los Osos).

File documents.....Administrative record for San Luis Obispo County coastal development permit (CDP) number DRC2008-00103; San Luis Obispo County certified Local Coastal Program (LCP).

Staff recommendation .....**Approve with Conditions**

A.Staff Recommendation

1. Staff Note

San Luis Obispo County's approval of a CDP for the proposed project in late 2009 was appealed to the Commission by multiple parties. On January 14, 2010, the Coastal Commission found that a substantial issue existed with respect to the grounds on which the appeals were filed, and the Commission took jurisdiction over the CDP application. Due to the manner in which the County acted on the CDP for the proposed project (an overall approval action followed by an amendment action to modify a portion of the project), there are two Coastal Commission appeal/application numbers associated with the proposed project, A-3-SLO-09-055 and A-3-SLO-09-069. However, there is only one proposed project, and these two applications have been combined as CDP application number A-3-SLO-09-055/069.

In its January 14, 2010 action, the Commission was generally satisfied with the core elements of the proposed project with respect to treatment plant siting, the gravity collection system, and the project's reuse concept overall. However, the Commission did direct staff to focus on seven main issue areas requiring additional clarification, correction, and/or potentially project changes to address LCP and Coastal Act requirements: 1) verification of wetland delineations; 2) mitigation requirements for the

proposed project relative to the prior abandoned wastewater treatment plant project at the Tri-W (Mid-town) site; 3) increased implementation specificity and timing, including with respect to conservation and agricultural reuse elements; 4) protection of Willow Creek; 5) impact identification and mitigation associated with potential alteration of groundwater flows; 6) issues associated with the proposed construction staging area; and 7) specificity with respect to septic tank decommissioning/reuse. Staff coordinated with the County and multiple Appellant groups on these and related questions, and the County and many interested parties provided significant materials to assist in this analysis. On this, staff makes three observations.

First, the proposed project, while simple in concept on its most basic level (i.e., enhanced wastewater treatment to address ongoing human and environmental health and safety problems), raises a series of interrelated and complicated issues relating to the manner in which this community can both cost-effectively meet its water and wastewater needs and protect the rich coastal resource areas within and around the Community. The seven identified issue areas all relate to these questions and each other in such a way to make it difficult to address these seven issues without addressing the project more comprehensively.

Second, although the core proposed project is a wastewater project, it will also significantly affect groundwater and thus water supply, and the two issues are not readily separated. Nor should they be, particularly given that this is a significant and expensive public works project. This opportunity should be taken to address on-going public service needs as comprehensively as possible, including with respect to the manner in which the location of the disposal of the treated wastewater can be used to maximize its groundwater/water supply utility within its basic framework.

Third, thoughtful consideration and analysis of the issues raised by the LOWWP requires significant time, including time for staff to coordinate with the County and with the numerous interested groups and persons who continue to be actively engaged on the project. The County has been understanding about the need for time for staff to properly review the issues and prepare a recommendation, but is also understandably concerned to have the matter heard as soon as possible. Most recently, the County has indicated that taking any more time (for example in order to provide more time for additional data creation/analysis, more time for interested parties to respond to this recommendation and the Commission otherwise, and/or more time to allow the matter to be heard at the Commission's San Luis Obispo hearing in August) would put potential federal stimulus funds for the project in jeopardy should the Commission act on the proposed project any later than the June Commission meeting.[1] Staff has conferred with the federal agency in question, and based on that consultation agrees with the County in that respect. Although the project may still qualify for such funds if the Commission acts later than June, the funds are available on a first-come, first-serve, competitive basis, and staff believes it is in the best interest of the success of the project for the Commission to take its action as soon as possible so as to maximize the project's eligibility to receive funding support that can offset local costs. The affordability of the project has been and will continue to be a major concern for the residents of Los Osos.

[1] The federal funds center around a potential $80 million funding package, or nearly half of the estimated project costs, that together with other funding sources being pursued by the County could reduce estimated property owner assessments for the project by roughly half.

Staff is therefore bringing this item forward for Commission consideration at the June hearing in Marina del Rey as opposed to the August hearing in the City of San Luis Obispo. While this will make it incrementally more difficult for interested parties to attend the hearing (as Marina del Rey is further from Los Osos than is the City of San Luis Obispo), staff believes that the desire for a more "local" hearing to facilitate local participation needs to be balanced against the need to bring this matter to timely resolution, including to preserve the best possibility for offsetting federal funds. In making this determination staff notes that the project (not even including prior incarnations raising similar issues) has been discussed and debated through over one hundred public hearings over the last four years, including through a well attended Commission hearing on the matter in January 2010, and it is hard to make a case that public participation has not been maximized in that process.

In conclusion, staff believes that the following recommendation addresses the issues the Commission identified in January, addresses the issues raised by interested parties, and provides for a wastewater treatment project that can successfully address ongoing resource degradation in the Los Osos area while also improving groundwater and other coastal resource protection in a manner appropriate for a major public works project. In addition to maximizing the avoidance and mitigation of resource impacts, the recommended conditions of approval provide for adaptive management of various issues, to the benefit of project implementation and resource protection. Although there may be potential for incremental refinements to the project through continued, more specific analysis, this potential must be weighed against the long-standing need to take action as soon as possible to protect water quality in Los Osos, including sensitive wetland, riparian, and groundwater resources.

2. Summary of Staff Recommendation

Los Osos is an unincorporated coastal community of about 15,000 residents that is located in central San Luis Obispo County at the south end of Morro Bay, a designated State and National Estuary that is well known and recognized as one of the most important biologic and wetland resources in California's coastal zone. Since at least the early 1970s, the Central Coast Regional Water Quality Control Board (RWQCB) and other agencies have raised environmental health and safety concerns regarding septic tank discharges communitywide adversely affecting ground and surface water, including Morro Bay. The RWQCB has taken a series of steps since that time to address the problem, and currently most of Los Osos has been under a RWQCB discharge moratorium since the mid-1980s.

In the time since there have been a series of ultimately unsuccessful attempts to address the identified ground and surface water pollution issues in Los Osos through construction and operation of a wastewater project. Environmental work and CDPs (each preceded by Commission approval of project-driven LCP amendments) have been approved by the County and appealed to the Commission for two different wastewater projects (including with different treatment plant sites) proceeding this one. Both of these projects were contentious, and engendered significant differences of opinion regarding the best method to address wastewater in Los Osos, including with respect to where to site a treatment plant. Most recently, the Commission approved a CDP for a different wastewater treatment project in Los Osos in 2004, but work on that project was halted in 2005, the CDP expired, and the project was never

would be addressed after construction staging was complete, staff recommends conditions to require the site to be returned to its current state or better following completion of the project as mitigation for using this site for a construction staging area.

Finally, in terms of the Commission's seventh identified issue, namely the need for specificity regarding septic tank decommissioning, it is clear that although the County's proposal generally describes the way in which septic tanks would be taken out of service and includes a County commitment to assist private landowners to reuse such tanks to optimize groundwater recharge, it appears possible that the County's CDP did not include sufficient specificy on how it would carry out this decommissioning project. Accordingly, conditions are included to ensure an appropriate tank decommissioning regime and reuse process, with the objective of reusing such tanks as much as possible to help with related groundwater and conservation problems.

Thus, staff recommends a series of conditions that help refine and better implement the proposed LOWWP. These conditions require revised plans showing revised treatment plant and pump station layout to avoid habitat issues, revised treatment plant access road to avoid agricultural impacts, and details on measures to be taken to ensure all project landscaping is limited to native and non-invasive species; a habitat management plan defining restoration, enhancement¸ management, and protection of the 80-acre Broderson site, the 12-acre Mid-Town (Tri-W) site, the roughly 8-acre habitat/buffer area at the Giacomazzi site, and a total of about an acre at the various pump stations sites (a total habitat management plan area of about 100 acres); agricultural easements (2:1) to address agricultural impacts at the treatment plant site and access to it; a septic system decommissioning plan to identify measures to appropriately decommission existing septic tank systems and to connect users to the approved project; a restriction on service to undeveloped Los Osos properties absent an LCP amendment that identifies appropriate and sustainable buildout limits; and an overall Los Osos basin recycled water management plan designed to ensure that the location of the wastewater disposal maximizes long-term ground and surface water and related resource (including wetlands, streams, creeks, lakes, riparian corridors, marshes, etc.) health and sustainability, including with respect to offsetting seawater intrusion as much as possible, through aggressive recycled water reuse, water conservation, monitoring, and adaptive management. The conditions also incorporate a methodology for future CDP amendment and for resolution of potential conflicts, and require the County to indemnify the Commission against 3rd party lawsuits.

As conditioned, staff believes that there is no feasible, less-environmentally damaging wastewater treatment project, including with respect to plant siting, and with respect to collection and effluent disposal methodologies and siting, as required by the LCP. In addition, the project has been conceived and designed to maximize the productive reuse of the effluent in the Los Osos basin, and to help improve groundwater health and sustainability. In short, the project as conditioned is a much needed and well-conceived beneficial coastal resource project that is essential to protect ground and surface waters in and near Los Osos, including the Morro Bay National Estuary and related habitats and resources, and to provide essential public services to the Los Osos area. Significant local and state resources have been dedicated towards addressing these needs over a period of more than 30 years, and environmental impacts and project alternatives have been thoroughly considered. The resultant project represents an

important environmental enhancement project of statewide importance that will greatly improve environmental health and safety associated with ground and surface water in and around Los Osos, including in Morro Bay, and including with respect to its related habitat resources. The project does entail certain impacts, but it is hard to conceive of a treatment project at this scale for this area that would not have such impacts. As conditioned, the LOWWP appropriately avoids such impacts where feasible, and appropriately mitigates for unavoidable impacts.

As such, staff believes that the conditioned project is consistent with the LCP and the Coastal Act's access and recreation policies, and recommends that the Commission approve a CDP for the proposed project. The motion to implement this recommendation is found directly below.

3. Staff Recommendation on CDP Application

Staff recommends that the Commission, after public hearing, **approve** the CDP for the proposed development subject to the standard and special conditions below.

> **Motion.** I move that the Commission approve Coastal Development Permit Number A-3-SLO-09-055/069 pursuant to the staff recommendation. I recommend a yes vote.
>
> **Staff Recommendation of Approval.** Staff recommends a **YES** vote. Passage of this motion will result in approval of the coastal development permit as conditioned and adoption of the following resolution and findings. The motion passes only by affirmative vote of a majority of the Commissioners present.
>
> **Resolution to Approve a Coastal Development Permit.** The Commission hereby approves the coastal development permit on the ground that the development as conditioned will be in conformity with the policies of the San Luis Obispo County Local Coastal Program and the public access and recreation policies of the Coastal Act. Approval of the coastal development permit complies with the California Environmental Quality Act because either: (1) feasible mitigation measures and/or alternatives have been incorporated to substantially lessen any significant adverse effects of the amended development on the environment; or (2) there are no feasible mitigation measures or alternatives that would substantially lessen any significant adverse effects of the amended development on the environment.

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C. Exhibits
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Exhibit 7: Coastal Commissioner Ex Parte Communications
Exhibit 8: Treatment Plant Site Modifications

B. Findings and Declarations

The Commission finds and declares as follows:

1. Project Location

Los Osos is an unincorporated coastal community of about 15,000 residents that is located in central San Luis Obispo County at the south end of Morro Bay roughly due west of the City of San Luis Obispo (see Exhibit 1). Upcoast lies the City of Morro Bay, and past that the community of Cayucos. Los Osos extends south and east from Morro Bay proper into the lower foothills of the Irish Hills and the Los Osos Valley. Historically, the Los Osos area was subdivided in the late nineteenth century into smaller lots (generally 25 to 50 feet by 125 feet) arranged along wider (generally 40 to 80 feet) streets arranged in a grid-like pattern, and the area was primarily intended as a location for summer homes and retreats. By the early 1960s, Los Osos had evolved into a tight-knit community of small-scale homes, many of them vacation homes. Although there has been redevelopment and some larger residential and other

types of projects that have brought a more finished facade to the area in more recent years, Los Osos continues to retain a small town look and feel that is firmly grounded in its historic roots.

Los Osos is located directly adjacent to Morro Bay, a designated State and National Estuary that is well known and recognized as one of the most important biologic and wetland resources in California's coastal zone.[5] Anchored by iconic Morro Rock, Morro Bay sustains a variety of distinct habitats as well as many sensitive plant and animal species. The Bay's rich resources support one of the state's largest waterfowl habitats, and it is an important stop on the Pacific Flyway attracting vast numbers of migrating birds to the area. Morro Bay also serves as an important nursery for both marine and anadromous fish, and provides a forage and resting area for marine mammals. The Bay also serves as a significant resource and home base for commercial and recreational fishing, recreational boating, and a diverse range of other water-oriented recreational opportunities. The Morro Bay watershed stretches inland to the foothills of the Santa Lucia Range, and a variety of coastal creeks and tributaries (including Los Osos, Warden, Chorro, and Morro Creeks) wend their way from the hills down through Los Osos and to Morro Bay. Los Osos' prime location along the back bay's frontage anchor its vitality directly to that of the Bay and its related resources, and visa versa.

Its location along the back Morro Bay environment also means that Los Osos is generally is located atop an ancient dune system formed by centuries of wind-blown sand coming from the southern end of the Bay. As a result, the terrain consists primarily of gently rolling hills and sandy soils. The sandy soils of Los Osos, its connection to the Bay, and its generally mild marine climate have combined to produce a unique coastal ecosystem that is home to a wide variety of adapted plant and animal species, some of which are found nowhere else in the world. These same landform attributes and others, such as varying depths to groundwater, also combine to confound wastewater treatment in Los Osos, almost all of which is based on the use of individual septic systems serving individual developed properties, and in some cases on larger septic systems serving multiple properties.

See Exhibit 1 for maps showing Los Osos and the surrounding area.

2. Project Background

Beginning in the early 1970's, the RWQCB and other health agencies began to raise environmental health and safety concerns regarding the use of septic systems in Los Osos.[6] In particular, the depth to groundwater in Los Osos was determined to be shallow enough in some areas to lead to inadequately treated septic discharges into ground and surface water, including due to flooding of leach fields in wet

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[5] Morro Bay was established as the first designated State Estuary in 1994, and it was accepted into the National Estuary Program shortly thereafter in 1995.

[6] Septic systems handle sewage by separating the sewage solids from the sewage fluids. Solids are collected in septic tanks and eventually pumped out and disposed off-site, while fluids flow directly into on-site soil through septic leach fields. Thus, a septic system's efficiency in neutralizing the liquid waste is dependent on the ability of the soil to treat and disperse sewage pollutants. Key controlling factors for soil in this respect include its composition and the vertical distance between leach fields and groundwater. When septic systems fail, either by direct leakage or by clogged and/or inoperative leach fields, there is high potential for ground and surface water contamination.

weather,[7] thus leading to environmental degradation, including to adjacent Morro Bay (from both surface flow and lateral seepage of inadequately treated septic discharge) and to groundwater resources more generally.[8] Groundwater contamination issues were and are compounded by the fact that the Los Osos area obtains its potable water supply from local groundwater aquifers.

The RWQCB took a series of steps to address these concerns, beginning with adopting an interim Basin Plan in 1971 that included a provision prohibiting septic system discharges in much of Los Osos after 1974. In 1983, the RWQCB subsequently determined that the situation was worsening, and adopted a wastewater discharge prohibition for a portion of the Los Osos area known as the Prohibition Zone (see Exhibit 1), finding as follows:[9]

- *Previous studies (Brown and Caldwell, 1983) indicated that the quality of water derived from the shallow aquifer underlying the community was deteriorating, particularly as it relates to increasing concentrations of nitrates in excess of State standards.*
- *The current method of wastewater disposal by individual septic tank systems located in areas of high groundwater may be a major contributing factor to this degradation of water quality. And,*
- *Continuation of this method of waste disposal could result in health hazards to the community and the continued degradation of groundwater quality in violation of the Porter-Cologne Act.*

In 1988, the RWQCB also established a discharge moratorium that effectively halted all new construction and all major expansions of existing development until a solution to the septic tank pollution problem could be developed and implemented. Even so, the identified problems have continued. More recently, the RWQCB indicated as follows in 1998:[10]

> *Monitoring data indicates much of the shallow groundwater in the most densely developed areas exceeds 45 mg/l, the drinking water standard for nitrate. For this reason, many of the shallow water supply wells have been removed from service and demand shifted to the deeper aquifer. Dependence on the deeper aquifer exacerbates the surface water problems because the community's water supply, formerly from the upper aquifer, is now drawn from the deeper aquifer and recharged (after use) to the upper aquifer causing groundwater levels to rise and*

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[7] For example, in the low-lying Baywood Park area of Los Osos few of the septic systems can meet RWQCB criteria for separation between the bottom of a leach field and groundwater. In addition, many of the smaller lots in Los Osos are too small for leach fields, and as a result they utilize deeper seepage pits that also can lead to inappropriate discharge to groundwater.

[8] Sewage contains a variety of constituents of significant concern to human and environmental health and safety, including primarily nitrates, bacteria (such as fecal coliform), and viruses. Excessive nitrate levels can lead to health problems and can also cause algal blooms in surface water, which consume large quantities of dissolved oxygen resulting in adverse impacts to aquatic life. Bacteria and viruses likewise pose potential health risks from direct contact with and ingestion of contaminants in surface and ground water, as well as through secondary consumption (e.g., eating contaminated shellfish).

[9] RWQCB Resolution Number 83-13.

[10] RWQCB letter dated July 10, 1998.

> *flood more septic systems. Increasing surface water impacts including: restriction of portions of shellfish harvesting areas because of rising bacteria levels; waters around the Los Osos area periodically do not meet bacteria standards for water contact recreation (such as swimming, wading, kayaking and small boat sailing); and the public is increasingly exposed to surface wastewater.*

There have been a series of attempts to address the identified ground and surface water pollution issues in Los Osos through construction and operation of a wastewater project. In the late 1980s and early 1990s, the County proposed a conventional wastewater collection and treatment project with a plant that would have been sited on rural agricultural land off Turri Road. In 1990, the Coastal Commission approved an amendment to the Estero Area Plan that would have allowed the Turri Road plant. The County subsequently abandoned the Turri Road plant site in favor of an alternative site, located at South Bay Boulevard and Pismo Avenue. In 1997, the County approved a CDP for that project and the County's action was appealed to the Coastal Commission.[11] The Commission conducted four public hearings on the project between 1997 and 1998, but ultimately did not take action on a CDP for the project, instead continuing it at least in part to allow the community an opportunity to pursue potential alternative wastewater projects, including alternative treatment plant sites.

In 1998 a local ballot measure formed the Los Osos Community Services District (LOCSD) and LOCSD pursued a new CDP for a conventional wastewater collection and treatment project with a plant that would have been sited in the middle of town along Los Osos Valley Road across from Ravenna Avenue (known as the "Tri-W" or "Midtown" site). In August 2002, the Commission approved an LCP amendment to allow a wastewater treatment and associated facilities as allowable uses on the Tri-W site.[12] In 2003, the County approved a CDP for the project and the County's action was appealed to the Commission. The Commission took jurisdiction over the CDP and ultimately approved the project with conditions in 2004.[13] In 2005, project construction commenced on the Tri-W site. In the fall of 2005, however, voters recalled a majority of the LOCSD board members in a special election and the new board immediately suspended construction on the wastewater project. The CDP subsequently expired, and to this date the Tri-W site remains the subject of active enforcement efforts at both the Commission and County levels.[14]

In 2006, wastewater authority for the Los Osos area was returned from LOCSD to the County,[15] and the County embarked on a long and inclusive local process that included evaluation of treatment plant siting, collection system approaches (e.g., STEP versus gravity flow), effluent disposal and reuse options, water supply, preservation of groundwater basins, protection of agriculture, and the protection

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[11] Appeal number A-3-SLO-97-040.

[12] LCP amendment number SLO-MAJ-3-01.

[13] CDP number A-3-SLO-03-113.

[14] Such efforts have focused to date on pursuing temporary site stabilization as opposed to permanent site restoration (i.e., to its pre-development condition) at least partially to allow the Tri-W site to be considered for potential wastewater treatment facility siting as part of the County's current efforts.

[15] Pursuant to Assembly Bill (AB) 2701 (Blakeslee).

provided there are no feasible alternatives.[30] In other words, the LCP allows for some ESHA disturbance for a public utility facility project, such as the current proposed project, provided it is the least environmentally damaging feasible alternative. In this context, the LCP still requires avoidance of ESHA impacts if feasible, but also recognizes that there may be circumstances where such projects result in unavoidable impacts, and the LCP allows such impacts if there is no feasible alternative.

In sum, the LCP generally limits new development in ESHA to resource dependent uses, and in wetlands to a limited set of uses otherwise; requires avoidance of and setback from ESHA and wetlands, including explicit and specific wetland setback prescriptions for Los Osos; and requires ESHA, wetland, and buffer enhancements where feasible and appropriate. The LCP also allows public utility facilities in such sensitive areas if there are no feasible alternatives as demonstrated via a feasibility study analyzing constraints and alternative locations.

2. ESHA Analysis

As previously indicated, Los Osos is located directly adjacent to Morro Bay, a designated State and National Estuary that is well known and recognized as one of the most important biologic and wetland resources in California's coastal zone. The Morro Bay watershed stretches inland to the foothills of the Santa Lucia Range, and a variety of coastal creeks and tributaries (including Los Osos, Warden, Chorro, and Morro Creeks) wend their way from the hills down through Los Osos and to Morro Bay forming the area's ESHA mosaic. Most of the Los Osos built environment has been constructed on ancient dunes formed by centuries of wind-blown beach sand that was deposited along the south end of Morro Bay, and as a result, the terrain of Los Osos consists of gently rolling hills and sandy soils, often referred to as "Baywood fines". The sandy soils and marine climate combine to produce a unique coastal ecosystem that is home to a wide array of plant and animal species, some of which are found nowhere else in the world. The dune, bluff, dune scrub, and chaparral communities that comprise this unique coastal ecosystem are all environmentally sensitive habitat areas (ESHAs). Since nearly all the urban area of Los Osos is underlain by sandy soil that supports ESHA or ESHA seed bank, the rebuttable presumption is that all sandy soil in Los Osos is considered ESHA. Thus, all of the undeveloped land within the main project area within the LCP's urban reserve line (that is, all of the land west of Los Osos Creek), including the remaining vacant parcels within this zone, are comprised of the same sandy soils constituting ESHA under the LCP.

Beneficial Impacts to Coastal Waters and Wetlands

As discussed previously, in addition to addressing contamination of the groundwater drinking water supply of Los Osos, a major part of the need for the LOWWP is to address pollution of environmentally sensitive coastal waters in and around Los Osos. In fact, the project is best characterized as a large scale environmental remediation and improvement effort that has been critically necessary for many years, and its implementation should result in significant resource enhancement and protection for a particularly sensitive series of resources, including the Morro Bay Estuary itself. To the extent the

[30] CZLUO Section 23.11.030 defines the term "Feasible" as: Capable of being accomplished in a successful manner within reasonable period of time, taking into account economic, environmental, social and technological factors.

project will address long-standing water pollution issues, the Commission finds that the project is consistent with the LCP's requirements to protect and enhance ESHA and coastal waters.

Direct Impacts to ESHA from Project Construction

Notwithstanding its overall benefit to sensitive resources, there will be some direct and adverse impacts to ESHA and sensitive wetland resources due to the project construction. These include impacts at the treatment plant site, the Broderson disposal site, various pump stations associated with the collection system, and a staging area, as well as potential impacts to surface resources from changes to hydrology. As discussed below, the County project has addressed many of the direct impacts appropriately through selection of the least environmentally-damaging alternative, avoidance, mitigation of impacts, and requirements for monitoring. In addition, the County has worked closely with Commission staff since the substantial issue hearing to revise the project to address wetland and ESHA issues.[31]

Avoidance of ESHA Impacts to the Maximum Extent

There continues to be some local disagreement over siting, collection, and disposal elements of the project. Nonetheless, the County's proposed use of the Giacomazzi site for the treatment plant site, and its gravity collection and effluent disposal methodologies are sound project alternatives. A detailed constraints and alternatives analysis, coupled with the project EIR, were used by the County to identify the collection system and disposal elements as well as to locate the treatment plant at the Giacomazzi site.[32] As discussed at the Commission's substantial issue hearing, other locations that could be considered to site such a facility each present similar and more difficult issues with respect to development of sensitive areas for purposes of LCP Section 23.08.288(d). So although there are some direct impacts (see below) associated with the proposed project and requiring modifications, the proposed project, including the treatment plant and including the collection and effluent disposal methodologies, as modified is appropriately considered to be the least environmentally damaging and most feasible alternative after taking into account economic, environmental, social, and technical factors.

Impacts at the Treatment Plant Site

One of the first and most important steps in the development review process is identifying the presence of ESHA and wetland resources within or adjacent to a proposed development site. At the substantial issue hearing for this project, concerns were raised that the County wetland delineations at the treatment plant site and other locations were not done using appropriate LCP criteria, thereby calling into question the ability to accurately avoid and/or mitigate ESHA wetland impacts as required by the LCP. Commission staff, including the Commission's ecologist, reviewed additional documentation, visited the treatment plant site (and the pump station and leach field sites – see below), and verified the location of wetlands (see Exhibit 6 for the Commission ecologist's complete analysis and findings). The

[31] See also County's response to the Commission on issues identified in the January substantial issue hearing in Exhibit 3.

[32] See Viable Project Alternatives Rough Screening Report (March 2007), Fine Screening Report (August 2007), and Final Environmental Impact Report LOWWP (September 2009).

eventually redirecting the tertiary-treated effluent back into the basin at various points. This redirection of water flows, and specifically the location and timing of wastewater discharges, raises issues concerning the long-term integrity of the groundwater basin, whether and how seawater intrusion would be affected, and potential impacts to riparian areas, coastal streams, and wetlands that may currently depend on effluent flows from existing septic systems.

As approved by the County, the LOWWP facility would be designed with a capacity to treat a maximum average annual dry weather flow of approximately 1.1 million gallons per day (mgd) that assumes the successful implementation of a water conservation program expected to save between 150,000 and 330,000 gallons per day for the County-estimated build out population of 18,428 residents within the collection zone.[63] At estimated indoor water use rates of 66 gallons per day per capita, the approximately 12,500 people who currently live in the proposed project area would generate wastewater flows of 825,000 gallons per day. The project has a goal of reducing indoor water use to below 50 gallons per day per person which would equate to 0.92 mgd wastewater flows at the projected buildout population of 18,428.[64] If this goal is met or exceeded and/or if buildout population is less, the project would operate at a higher level of redundancy (i.e. excess capacity to meet demand).

	Estimated Indoor Water Demand (gpcpd)		**Estimated Wastewater Generation (gpd)**		**Total AFY**
	Current	**With 25% Conservation**	**Current**	**With 25% Conservation**	
Current Population (12,500)	66	50	825,000	625,000	700
Buildout Population (18,428)	66	50	1,216,248	921,400	1,032
Inflow and Infiltration	--	--	300,000	300,000	336
Total			**1,516,248**	**1,221,400**	**1,368**

As proposed by the County, the project will only be serving existing development in the short-run, as new development will not be allowed to hook up to the project until habitat and groundwater management planning is completed and incorporated into the LCP, in order to address issues related to the potential impacts of the new development facilitated by the new treatment capacity. Thus, the project will only have need for the disposal of approximately 700 AFY in its initial phase.

The County's project includes tertiary filtration with ultraviolet disinfection designed to meet California Title 22 standards for tertiary recycled water. This non-potable recycled water will be reused within the community or on surrounding agricultural land overlying the groundwater basin by discharge through leach fields and through direct reuse for urban and agricultural irrigation. The proposed project's reuse program includes the following:

[63] Id (buildout note yet established per LCP, and could be lower).

[64] The County recognizes that there is some uncertainty with the estimated per capita water use; 66 gallons per day per capita (gpdpc) is somewhat lower than the average daily use implied by the 1,157 AFY of existing flow of septic into the proposed service area assumed by the hydrologic modeling of the project, which equates to 82 gpdpc.

- Recycled water storage at the treatment plant site, with a capacity of 50 acre-feet.
- A recycled water main running from the treatment plant site to reuse sites within the community.
- 8 acres of new leach fields at the Broderson site, with an annual capacity of 450 acre-feet.
- Use of the one-acre existing leach field in the Bayridge Estates sub-division, with an annual capacity of 33 acre-feet.
- Provision of approximately 130 acre-feet of recycled water to Los Osos schools, parks, golf course, and the cemetery.
- Provision of recycled water main turn-outs to adjacent farmlands, with annual reuse estimated to account for approximately 100 to 200 acre-feet.

In the short run, the County indicates that the approximate 700 AFY generated by the project will be directed to the Broderson site (448 AFY), Bayridge Estates (33 AFY), urban reuse (144 AFY), and agricultural irrigation (86 AFY) (see Exhibit 3).

Overall, the County-approved project includes numerous components to address the distribution of the recycled water generated by the project, including an overall requirement to beneficially discharge such water only within the Los Osos Groundwater Basin. Components of the proposed project addressing recycled water reuse include the following:[65]

> *97. Disposal of treated effluent shall be reserved for the following sites/uses in the Los Osos Groundwater Basin:*
>
> *a) Broderson (not to exceed 448 AFY on an average annual basis,)*
>
> *b) Urban re-use with the urban reserve line (as identified in the Effluent Re-Use and Disposal Tech Memo, July 2008),*
>
> *c) Agricultural re-use overlying the Los Osos Groundwater Basin, and*
>
> *d) Environmental reservations (not less than 10% of the total volume of treated effluent).*
>
> *Total agricultural re-use shall not be less than 10% of the total treated effluent. Disposal shall be prioritized to reduce seawater intrusion and return/retain water to/in the Los Osos groundwater basin. Highest priority shall be given to replacing potable water uses with tertiary treated effluent consistent with Water Code Section 13550.*
>
> *No amount of treated effluent may be used to satisfy or offset water needs that result from non-agricultural development outside the Urban Reserve Line of the community of Los Osos.*

[65] Id (County conditions that are part of proposed project – see Exhibit 2).

location will be adequately protective of habitat resources because other leach field sites would be more habitat damaging, the area would be restored as part of the wastewater treatment project (and re-restored following maintenance cycles), and such facilities are allowed under the LCP if they are the least environmentally damaging feasible alternative. Within this context, and premised on the proposed long term enhancement, restoration, management (including funding), and protection of the 80-acre Broderson site that is proposed and should be required, I believe that the leach field portion of the project appropriately protects ESHA and wetlands.

The proposed leach field will periodically directly disturb 8 acres of the lower coastal scrub portion of the property, beginning with initial installation and then through the anticipated maintenance of the leach field every 5-10 years. Although ideally this impact to ESHA would not be required, it is the least environmentally damaging, feasible alternative for this component of the wastewater discharge element of the LOWWP.

Impacts at Pump Stations

The project includes nine pump stations and thirteen pocket pump stations that provide continuous pressure in the force mains, enabling the transfer of wastewater to the treatment plant from areas that cannot be served by gravity. The pump stations are located throughout the community on vacant lots or within public rights-of way and are run by dedicated stand-by power facilities. Because nearly all the urban area of Los Osos is underlain by fine sandy soil that supports ESHA, some amount of impact due to the pump station footprint is unavoidable (see following discussion for more detail on unavoidable project impacts). Concerning the project pump stations, including the Midtown site, the following findings have been made by the Commission's staff ecologist:

The majority of the Los Osos community has been constructed on ancient dunes formed by centuries of wind-blown beach sand that was deposited along the south end of Morro Bay. As a result, the terrain consists of gently rolling hills and sandy soils, often referred to as Baywood fines. The sandy soils and marine climate combine to produce a unique coastal ecosystem that is home to a wide array of plant and animal species, some of which are found nowhere else in the world. The dune, bluff, dune scrub, and chaparral communities that comprise this unique coastal ecosystem are all environmentally sensitive habitat areas, or ESHA.

Since nearly all the urban area of Los Osos is underlain by sandy soil that supports ESHA or ESHA seed bank, the presumption is that all sandy soil in Los Osos is considered ESHA. As such, siting a wastewater treatment project in Los Osos outside of ESHA is likely impossible. As indicated above, my understanding is that the LCP allows for some ESHA disturbance for such a project provided it is the least environmentally damaging feasible alternative. Within this context, the County has examined various options for pump station, leach field, and staging area locations, and has made extensive efforts to identify the least environmentally damaging alternatives. To this end, all the project component locations identified by the County are disturbed sites heavily impacted by invasive species; the only exceptions are the Midtown and Broderson sites that, while invaded by non-natives, still support large areas of native plant

> *downstream properties from drainage problems resulting from new development. The standards of Sections 23.05.042 through 23.05.050 are applicable to projects and activities required to have land use permit approval.*

Thus, to address nonpoint source pollution from urban development, the LCP focuses on controlling erosion and sedimentation, on managing drainage patterns to reduce erosion and runoff, and on siting development off steeper slopes.

2. Water Quality Analysis

The LCP includes a suite of policies and ordinances designed to protect coastal water quality. A major reason for the LOWWP is to resolve longstanding impacts associated with septic seepage polluting the groundwater basin and area surface waters. As described, the RWQCB and other health agencies became concerned with the use of individual septic/disposal systems in the early 1970's when it was identified that the depth to groundwater is shallow enough in some areas of Los Osos to flood leach fields in wet weather. Surface flow and lateral seepage of inadequately treated wastewater posed adverse impacts to Morro Bay. Significant concerns were also raised regarding the impacts of septic systems on groundwater resources, particularly because the Los Osos area obtains its water supply from groundwater aquifers. In 1988, the RWQCB established a discharge moratorium that effectively halted all new construction and all major expansions of existing development until a solution to the septic tank pollution problem could be developed and implemented. In 1995, a study issued by the RWQCB titled "Assessment of Nitrate Contamination in Ground Water Basins of the Central Coast Region Preliminary Working Draft", highlighted significant increases in nitrate concentrations in both the lower and upper aquifers. According to a letter from the RWQCB on July 10, 1998 regarding the study:

> *Monitoring data indicates much of the shallow groundwater in the most densely developed areas exceeds 45 mg/l, the drinking water standard for nitrate. For this reason, many of the shallow water supply wells have been removed from service and demand shifted to the deeper aquifer. Dependence on the deeper aquifer exacerbates the surface water problems because the community's water supply, formerly from the upper aquifer, is now drawn from the deeper aquifer and recharged (after use) to the upper aquifer causing groundwater levels to rise and flood more septic systems. Increasing surface water impacts including: restriction of portions of shellfish harvesting areas because of rising bacteria levels; waters around the Los Osos area periodically do not meet bacteria standards for water contact recreation (such as swimming, wading, kayaking and small boat sailing); and the public is increasingly exposed to surface wastewater.*

According to the RWQCB, in areas where depth to groundwater is shallow, many of the seepage pits discharge directly into the upper aquifer with no separation. Contaminated groundwater sometimes reaches the surface, especially during the rainy season.[71] In a 2002 support document for Morro Bay regarding total maximum daily load for pathogens (including Chorro and Los Osos Creeks) the

[71] California Regional Water Quality Control Board. 2001. Status report on the Los Osos Community Services District wastewater project, San Luis Obispo County. San Luis Obispo, California.

RWQCB indicated that elevated levels of fecal coliform were present in Morro Bay and that other pollutants such as bacterial, viral, or cyst forming pathogens may also be present.[72] According to the same report, portions of the commercial oyster beds in Morro Bay have been closed for harvest by the California Department of Health Services per the United States Food and Drug Administration's National Shellfish Sanitation Program standards because of high fecal coliform levels. Based on the levels of fecal coliform, seasonal restrictions have been imposed on commercial shellfish harvesting in other portions of Morro Bay; however, no restrictions are in place on non-commercial shellfish harvesting related to fecal coliform levels (CRWQCB 2002). This information prompted further action to address the issue of groundwater contamination as well as possible impacts to surface water resources around the Los Osos area.

Despite the benefits to coastal water quality and the marine habitats of the Morro Bay National Estuary offered by the proposed replacement of septic systems with a wastewater treatment plant, some impacts to water quality can be anticipated. Fortunately, water quality impacts can be resolved by applying special conditions to the permit approval. Some of the special conditions are new, while other build on and improve existing County conditions. Only with these special conditions is the project consistent with the LCP's water quality protection standards.

Inflow and Infiltration (I/I)

A common cause of sewer system overflows is due to the infiltration of groundwater and rainwater into sewer pipes, commonly referred to as inflow and infiltration (I/I). To address this issue, the County selected a "sealed system" which is not anticipated to leak under appropriate installation practices. According to the County, the materials used are subject to standards which specify zero leakage. The County will use fusion welded or chemically sealed pipes and will do additional inspections in the field during construction to ensure proper installation in areas of high groundwater to further reduce I/I (see County condition 98, Exhibit 3). In other words, the County-approve project includes appropriate safeguards to address I/I. That said, it should be noted that any system, including pressurized systems, constructed in the field and subjected to various environmental factors, over time has some potential for failures of various kinds. According to the County, conservative design parameters for wastewater treatment plants include designing for infiltration, even when the potential for such flows to occur is low, and with modern operational requirements applied, will be insignificant. In short, the County approval recognizes I/I and the project takes appropriate precautions to protect coastal resources, including the Los Osos Groundwater Basin and Morro Bay, from potential I/I and sewer overflow impacts.

High Groundwater

It has been suggested that areas of high groundwater have not been adequately addressed and should be expanded to account for areas of seasonal high groundwater. Contentions have been made that the use of fusion welded pipes should be expanded to account for the expanded seasonal high groundwater areas. According to the County, elastomeric/bell and spigot pipes are a "sealed system" and are not anticipated

[72] California Regional Water Quality Control Board. 2002. Support document for Morro Bay total maximum daily load for pathogens (including Chorro and Los Osos Creeks). San Luis Obispo, California.

to leak under appropriate installation practices. Furthermore, the areas of high groundwater are based on nearby monitoring wells, and according to the County reflect the best available information related to groundwater conditions. County condition 98 also includes provisions for sea level rise and areas of groundwater as identified in the field during construction. Concerns were also raised with regards to dewatering activities and the resulting placement of the water. According to the County, all dewatering activities will be authorized in accordance with the RWQCB standards, as required by County condition 14. Thus, the project includes appropriate measures to deal with areas of high groundwater.

Nitrates

The project includes nitrate removal as part of the effluent treatment process. As noted by some, nitrate rich effluent can be beneficial to local growers. This has been shown to be the case in other effluent reuse programs, such as in Monterey County. However, as described by the County, the amount of nitrates that would be authorized in the treated effluent will be dictated by the RWQCB through their discharge permit. The County notes in their approval that municipal wastewater effluent typically contains approximately twice the nitrate concentration than what can be efficiently taken on by plants. Therefore, even if all of the effluent were used for urban and agricultural irrigation, according to the County, nitrate removal would still be necessary.

Harmful Discharges

Concerns have been raised that pollution of Morro Bay is likely at the Giacomazzi site because spills could flow directly into Warden Lake and then into Morro Bay. While the Giacomazzi site is located closer to a surface water body than some of the alternative sites studied, the site will be designed to contain any potential spills and site runoff within the boundaries of the treatment facility. According to the County, any spill/runoff from the site would be designed to flow back through the treatment process as opposed to being discharged offsite, thereby minimizing any potential for contamination of Warden Lake and/or Morro Bay. Additionally, plant operations will be monitored 24 hours per day to ensure proper operations of the facility. The facility will be equipped with a backup generator in case of a power failure and procedures identifying manpower and equipment for an efficient response in the event of an accidental release of chemicals or effluent from the facility or collection system pipelines (see County conditions 25 and 46, Exhibit 2)

Concerns have also been raised that the project will result in harmful discharges to Morro Bay and the Los Osos groundwater basins due to incomplete removal of harmful substances; the disposal system will adversely impact drinking water supplies; the project will not adequately remove salts, carcinogens, pharmaceuticals, endocrine disruptors, and other pollutants and will therefore not achieve a safe or sustainable source of potable water; and the project poses human health risks. However, concerns regarding the plant's ability to effectively remove harmful substances from wastewater, and dispose of the treated effluent and sludge in a manner that protects human health and safety, are issues addressed by RWQCB waste discharge requirements and Department of Health Services regulations. Further, the primary reason for the project is to reduce harmful discharges to Morro Bay and the Los Osos groundwater basins. In fact, the RWQCB has determined that construction and operation of the proposed facility is necessary to protect and restore the water quality of the Los Osos groundwater basin

and the Morro Bay National Estuary.

Construction BMP's

To protect water quality during and after construction, the County is responsible for: obtaining a National Pollutant Discharge Elimination System (NPDES) permit from the RWQCB that must also be approved by the County Engineering Department; preparing a final grading, drainage, and erosion control plan for the Giacomazzi site that incorporates the recommendations of a geotechnical engineering evaluation; and, developing a long-term erosion control plan that identifies the erosion control practices to be implemented throughout the construction and operation of the wastewater treatment facilities. In accordance with RWQCB and DOHS requirements, the County will prepare an Emergency Response Plan that will prescribe procedures for responding to sewer or chemical spills. Standards for seismic and geologic safety, and a requirement for a Hazardous Materials Management Plan, have been attached as conditions of permit approval and further serve to ensure project compliance with the marine resource protection objectives of the LCP. Most importantly, correcting water quality problems associated with existing septic discharges will have a beneficial impact on the Morro Bay National Estuary.

3. Project Modifications to Result in an Approvable Project

The LCP focuses on controlling erosion and sedimentation, on managing drainage patterns to reduce erosion and runoff, and maximizing groundwater recharge. One issue identified by Commission Staff involves the incorporation of low impact development (LID) techniques into street reconstruction. With a nearly every road in the community trenched, opportunities to implement such development techniques consistent with the LCP are abundant. Special condition 1(j) requires that all public roadway work, including complete roadway reconstruction, be done in a manner that includes LID and other water quality protection systems to the maximum degree feasible.

4. Water Quality Conclusion

As conditioned, the project will improve water quality, and will thereby have a beneficial impact on marine habitats. Adverse impacts posed by project development and operations are addressed by conditions regulating construction activities (e.g., grading, dewatering, and erosion control), drainage improvements, hazardous material containment, and seismic safety. As conditioned for the implementation of expanded LID techniques, the project will be designed to address water quality issues during street reconstruction and can be found consistent with the LCP water quality policies as cited in this finding. As conditioned, the project is consistent with the LCP with respect to water quality.

F. Public Views

As discussed below, the proposed project does not comply with LCP policies protecting public views, and special conditions are needed to bring the project into conformance with the LCP in this respect.

1. Applicable LCP Policies

Hydrogeologic Impacts

Coastal Commission Staff Comment:

Hydrogeologic Impacts. Similar to the Willow Creek issue (see above) but on a broader scale, the Commission was concerned that there was a lack of impact identification and mitigation associated with the manner in which the project is going to alter groundwater flows, including with respect to adaptive management, over time. Although we all realize that at a broad scale the project concept is to enhance marine and groundwater resources (and associated resources, like wetlands, streams, riparian areas, etc.), the concern is that there is not enough specificity with respect to the manner in which this is to occur, when it is to occur, how it is to occur, and what contingencies are in place should certain features not work as well as planned and/or should certain components lead to adverse impacts (e.g. monitoring of Broderson disposal). It could be that the County intends the Groundwater Plan (condition 87) and related measures (i.e., condition 97) to be the vehicle for addressing this issue, but it appears clear that the Commission is looking for greater specificity than that vehicle, including in terms of identifying specific impacts and specific response now as part of the approval of the project to the degree possible. Please package together an analysis of this issue that includes a clear identification of existing and proposed flows, impacts and mitigations associated with changed flows, and a 'balance sheet' documenting benefits as well as adverse impacts and responses. Please send a copy of the materials to Mark Johnsson in our San Francisco office (45 Fremont Street, Suite 2000, San Francisco, CA 94105-2219) and a copy to us in Santa Cruz. Ultimately, we should work on identifying a specific, enforceable plan that ensures resources are protected as much as possible as the project modifies flows over time, and ideally the bulk of such plan could be packaged together now.

Response:

One of the key objectives of the Los Osos Wastewater Project involves moving beyond mitigating the project's potential seawater intrusion impacts by including project components and programs that maximize the beneficial reuse of recycled water. These project elements (Broderson, Bayridge, urban reuse and agricultural reuse) all serve to enhance groundwater resources in the basin. By design, these elements provide benefits to the groundwater basin and at the same time avoid negative impacts. Nevertheless, the manner in which the project will alter groundwater flows, with respect to short-term and long-term impacts, has received an extensive level of study, with a high level of specificity related to key issues of concern, such as wetlands and riparian areas, groundwater quality, water supply quantity, down-gradient effects of Broderson, and local water supply policies. Based on this analysis, the EIR concludes that groundwater impacts will be beneficial in many cases, adverse impacts will be less than significant in all cases, and no additional groundwater mitigation measures are needed.

The project EIR, in Section 5.2 "Groundwater Resources" and in Appendix D: "Groundwater Quality Resources," provides a detailed analysis of groundwater effects

associated with the project and contains the "Hydrogeological Impacts Study" completed in October, 2008, by Hopkins Groundwater Consultants for the project. The Hopkins study references the groundwater basin modeling completed for the project by Cleath and Associates, which is included as Appendix C to Section D-2. The groundwater modeling completed for the project is a continuation of ongoing efforts begun by Yates and Willams (2003) to evaluate nitrogen concentrations and further developed by Cleath and Associates (2005) to evaluate sea water intrusion.

The groundwater modeling completed for the project is summarized in a series of hydrologic budget tables and diagrams with estimated groundwater flows developed for each major area of the basin for the current condition and project condition. The corresponding changes in ground water elevations are also estimated and presented in tables and contour maps. Long term conditions with the proposed project include the following:

- The basin will continue to have a large excess of groundwater flowing out to surrounding surface waters.
- Sea water intrusion will be reduced as a result of the project.
- Well production is assumed to be maintained at the current demand level.
- Upper aquifer water levels will be affected by plus or minus one foot along the bayshore.
- Lower aquifer water levels will be raised up to two feet in the basin.

Regarding contingency plans for potential unforeseen groundwater impacts, they can be divided into three categories: wetlands, groundwater supply, and Broderson leachfields geology/hydrogeology.

Wetlands: The EIR analysis shows that impacts to wetlands will be less than significant. While groundwater outflow to surface water primarily to Morro Bay will be somewhat reduced, a significant amount of flows will be maintained, and more importantly, groundwater levels are expected to remain high. In approving the LOCSD project in 2004 the Coastal Commission conditioned a "Groundwater Level Monitoring and Management Plan" to be developed in order to ensure that no impacts did occur, and to provide a mechanism to respond to any issues that developed. The LOCSD version of this plan has already been prepared and was approved by Commission staff in January 2005. Even though the analysis shows that substantial impacts are not expected to occur, the County has adopted the same approach and included the same requirements in the current project as condition #87. Given the results of the impact analysis, developing specific contingencies to respond to unanticipated wetlands changes would be speculative at this time. However, in conversations with the community, the County has identified three potential strategies to address wetlands changes, should they occur:

1. Implement LID projects to capture stormwater and introduce back into the ground at strategic locations

2. Further promote septic system leach filed LID conversions in strategic areas

3. Introduce recycled water into strategic locations via the projects backbone purple pipe system

Groundwater supply: A primary benefit of the project is the remediation of the long standing water pollution problem caused septic tank discharges, which has led to high nitrates in the upper aquifer. With a significant source of nitrates removed from the basin, the water quality will increase over the long term and lead to an increase in useable water supply.

In the short term, however, the collection of septic tank discharges is expected to have a potential adverse impact on the existing sea water intrusion in the lower aquifer. The project, as designed and conditioned, will provide more than a 3:1 mitigation of the potential sea water intrusion impacts and result in a beneficial groundwater impact. The project also implements the foundation for long-term water sustainability in Los Osos.

As currently proposed, the conservation plan will reduce wastewater flows to an estimated 700 AFY for the current population. Recycled water will be directed in the following manner.

- Broderson leachfields: 448 AFY
- Bayridge Estates leachfields: 33 AFY
- Urban irrigation reuse program: 133 AFY
- Agricultural irrigation reuse program: 86 AFY

The conservation and irrigation reuse programs will result in an immediate and guaranteed reduction in groundwater pumping, thereby ensuring at least 2:1 mitigation of potential sea water intrusion impacts. The Bayridge Estates leachfields are not anticipated to mitigate sea water intrusion, so no contingencies are necessary. The Broderson leachfields are estimated to provide a 20% mitigation factor, resulting in 90 AFY of mitigation. If the mitigation factor is not fully realized, the project will still provide at least 2:1 mitigation through conservation, irrigation reuse, and some level from Broderson.

The project will mitigate its own potential sea water intrusion impacts and provide additional water supply benefits to both the upper and lower aquifers. However, there is no physical solution whereby the wastewater project can stop sea water intrusion. The ultimate solution for stopping sea water intrusion will require a number of measures beyond the control of the wastewater project. Recent analysis shows that the current pumping demand, including urban uses, is within the basin safe yield and concludes that water purveyor pumping patterns can be adjusted in order to stop the sea water intrusion problem. This can be done in parallel with the wastewater project and is aided by the project conditions for conservation, irrigation reuse, and Broderson leachfields. Regarding new development, project condition #86 requires that additional water supply

must be identified to sustainably meet build-out demand and incorporated into an Estero Area Plan amendment prior to any connection to the project by new construction.

Broderson leachfields geology/hydrogeology: Percolation of treated wastewater in the Broderson area has been included in every project description for the Los Osos wastewater project since its inception in the 1980's. Over the course of the last 25 years, there have been dozens of studies and reports, completed by over 20 agencies and technical consultants, which have included evaluation of the Broderson area for percolation of treated wastewater. As a result, the geology and hydrogeology have been extensively studied and the specific conditions and responses are relatively well known.

- The underground conditions of sand and clay layers have been documented with test hole drilling.
- Soil tests to determine liquefaction potential have been conducted.
- Groundwater flow conditions under Broderson, and down-gradient, have been modeled.
- Perhaps most importantly, extensive pilot testing of two different percolation methods have been conducted to document soil percolation rates and underground water level response.

The extensive testing and analysis has led to a project description that avoids all potential adverse impacts from the Broderson leachfields, and is expected to provide multiple beneficial impacts.

The proposed project includes the use of the Broderson leachfields at half the rate (448 AFY vs. 896 AFY) than previously approved by the Coastal Commission for the LOCSD project. This is because the LOCSD included plans for harvest wells in low lying areas down-gradient from Broderson to remove up to 448 AFY to prevent high groundwater levels. Due to the uncertainty and inefficiency of the disposal of harvest water, and that the County is not a water purveyor, the County did not include harvest wells in the project description and correspondingly reduced the disposal rate at Broderson. The design and capacity of the Broderson site remains unchanged, thereby doubling the redundancy and factor of safety of the leachfields.

Based on this conservative approach, the potential for adverse impacts is even less likely and specific contingencies to identify when, where and how to address potential impacts would be speculative. However, the County has adopted the approach previously approved by the Coastal Commission for the LOCSD project and included the same requirements for a "Groundwater Level Monitoring and Management Plan" in the current project permit as condition #87.

An additional benefit of the "Groundwater Level Monitoring and Management Plan" for the proposed project is to evaluate the ability to increase the disposal rates at Broderson. The sea water intrusion mitigation benefits of the Broderson leachfields, which are centrally located in the high demand urban area, are expected to be greater

Willow Creek Impacts

Coastal Commission Staff Comment:

Willow Creek. The contention is that the project results in an unaddressed and unmitigated 400 afy reduction in flow to Willow Creek to the detriment of creek. We understand that the Bayridge leach field would be used to put back 33 afy as part of the project, and that the County apparently found that this 33 afy would be an equal offset to existing septic flows, but we would like a clearer explanation as to why the County found this to be the case, and how project flows will affect Willow Creek resources. Please provide an analysis with supporting documentation (again, new product and/or direction to information).

Response:

Detailed analysis of groundwater effects is included in Appendix D, Section D-2: Hydrogeological Impacts Study in the project EIR. The analysis includes a hydrologic budget summary of the groundwater basin. The data is presented by Hopkins Groundwater Consultants in Table 8 through Table 10 of Section D-2. The original analysis was completed by Cleath and Associates in a memorandum dated August 7, 2008 and is included as Appendix C to Section D-2. The data related to the perched aquifer, which underlies the Willow Creek area is summarized below.

From Table 2 "Hydrologic Budget Summary June 2008" by Cleath and Associates			
Aquifer	Budget Item (Basin IN/OUT)	Current Condition (AFY)	Project Scenario VPA 2b (AFY)
Perched Aquifer	Septic Return (IN)	631	36
	Percolation of precipitation/irrigation return (IN)	736	736
	Leakage/subsurface outflow to upper aquifer	698	634
	Leakage/subsurface outflow to creek compartment	117	103
	Willow Creek outflow/evapotranspiration (OUT)	552	35

A simple reading of the hydrologic budget tables in the EIR may result in concern for impacts to Willow Creek. However, the discussion in the analysis and an understanding of the source data demonstrate the following:

1. The line item for Willow Creek outflow/evapotranspiration (OUT) is the total of all leftover groundwater which flows out of the perched aquifer under the analyzed conditions. The title includes "Willow Creek" because it is a major component of the outflows, but the outflows are a calculation of the excess groundwater for the entire 1,326 acre area of the perched aquifer.

2. The volume of excess groundwater that is lost from the groundwater basin is calculated after accounting for rainfall, runoff, evapotranspiration, irrigation, and

septic returns needed to support existing vegetation. The amount of runoff, evapotranspiration, residual potential evapotranspiration, and irrigation remain constant for both current conditions and project conditions.

3. The maximum amount of septic leachate to be collected by the wastewater project that may currently be flowing to Willow Creek is approximately 150 AFY - 170 AFY (only portions of Zones 115, 117, and 118 can be assumed to flow to Willow Creek), of which 33 AFY is conditioned to be treated and returned to the existing Bayridge Estates leachfield. The claim that 400 - 500 AFY of flows will be removed from Willow Creek cannot be correct.

4. Septic leachate is a significantly smaller source of perched aquifer input than rainfall and irrigation, and there is no evidence that groundwater levels will be significantly reduced in the area of Willow Creek, where shallow clay layers will maintain relatively high groundwater levels. The shallow depth of the clay layers is also evidenced by the existence of Eto Lake and two upstream ponds along Willow Creek.

5. It is clear from the documentation in the analysis that only a portion of the change in flows between the current conditions and project conditions, as a result of removing septic tank discharges, can be associated with Willow Creek. After project development there will continue to be excess groundwater in the perched aquifer that is transported out of the basin, including outflow to Willow Creek

The comparison of aerial photographs from pre-development conditions is also a useful tool for predicting wetlands and riparian impacts. The attached figures show a comparison of pre-development (1949) and current conditions. The extent of wetland and riparian areas were much greater in pre-development conditions and demonstrate that the naturally occurring high groundwater levels in the perched aquifer are sufficient to support the existing habitat.

The Hydrogeological Impacts Study in the project EIR concludes that, while flow rates may be reduced, drainage will still occur in the Willow Creek area and that seasonal runoff and shallow groundwater are anticipated to provide sufficient water for use by the riparian vegetation established well before the Los Osos community was developed.

The EIR conclusion was reached prior to the addition of a project permit condition to place 33 AFY of recycled water at the Bayridge Estates leachfields. The nexus for the inclusion of the Bayridge Estates leachfields as a permit condition was the effort to find additional disposal capacity for the project, in order to eliminate the reliance on sprayfields. A secondary benefit of this condition is that it provides an additional level of protection for the Willow Creek drainage beyond that which was provided by the LOCSD project previously permitted by the Coastal Commission or that analyzed in the current project EIR, which found that there would not be any significant impacts to Willow Creek, even without the return of 33 AFY of recycled water to the Bayridge Estates leachfield.

Long-term Operational Effects

As with Proposed Project 1, the potential for groundwater impacts of the project disposal sites during operation of facilities for Proposed Project 3 would be the same less than significant impact as described above for Propose Project 1.

Combined Project Effects

Short-term Construction Effects

The potential for groundwater impacts of the combined project during construction of facilities for Propose Project 3 would be the same less than significant impact as described above for Proposed Project 1.

Long-term Operational Effects

The potential for groundwater impacts of the combined project during operation of facilities for Proposed Project 3 would be the same as described above for Propose Project 1. Impacts to the Zone B and C aquifer is considered less than significant. The potential impact on the exact quantity of groundwater in the perched aquifer is unknown and the potential impact on groundwater flow to surrounding surface water features is speculative given that the amount of perched groundwater currently flowing to surface water features is not known. Furthermore, the proposed disposal of treated effluent at Broderson would reduce the current rate of seawater intrusion into the lower aquifer, thus resulting in a beneficial impact.

Proposed Project 4

Proposed Project 4 includes a gravity sewerage collection system and a facultative pond wastewater treatment facility at the Tonini site that provides secondary level treatment. The raw wastewater conveyance system carries the collected wastewater from the Mid-Town pump station to the combined Tonini wastewater treatment plant site. Treated effluent can be sent directly through the treated effluent conveyance system to the Broderson leachfield. Alternatively, some or all of the treated effluent can be sent to the nearby Tonini spray fields and or seasonal storage pond on the Tonini site

Collection System

Short-term Construction Effects

The short-term effects on ground water supplies from the construction of the collection system associated with proposed project 4 would be the same as the short-term effects associated with Proposed Project 1.

Long-term Operational Effects

Long-term effects on ground water supplies from the proposed collection system associated with Proposed Project 4 would be the same as the long-term effects associated with Proposed Project 1.

Treatment Plant Site

Short-term Construction Effects

The existing groundwater table is at 7 feet to approximately 40 feet below existing grade. Construction of the proposed treatment facilities will not extend to the groundwater table. As with Proposed Project 1, construction activities associated with the proposed treatment facilities in

February 26, 2010

Dan Carl
California Coastal Commission
725 Front Street Suite 300
Santa Cruz, CA 95060

Subject: Additional CDP Materials for the Los Osos Wastewater Project

Dear Mr. Carl:

Enclosed with this letter is a set of materials responding to the following items from your January 26, 2010 email requesting additional information on the Los Osos Wastewater Project. With these materials we believe we have responded to all seven of the issues raised by your email.

1. Willow Creek response with attachments:

   - EIR Appendix D
   - Historic Wetland Aerial Photos

2. Hydrogeologic response with attachments:

   - Topical Response 8: The Broderson Leachfield
   - EIR Appendix D (with Willow Creek Materials)

2. Septic Tank Decommissioning Response

Per your instructions a copy of this transmittal letter together with a copy of items 1, 2, and 3 above has also been sent to:

Mark Johnsson
California Coastal Commission
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219

We look forward to working with you on the identified issues in Los Osos. As always, we are anxious to move the process forward expeditiously as we work on numerous fronts to solve the long-standing water pollution issues in Los Osos. If you have any questions or need more information regarding these topics please feel free to contact me.

Sincerely,

MARK HUTCHINSON
Environmental Programs Manager

Attachments

c: Paavo Ogren, Director of Public Works
John Waddell, Project Manager

File: Los Osos Wastewater Project 300337.03

2. County Authority

It is important to be aware that the Los Osos Wastewater Project has as its primary goal the elimination of water pollution from septic tanks. The focus of the project is compliance with the Regional Water Quality Control Board's discharge prohibition. By accomplishing this goal, the Project will remove a significant threat to water sustainability in Los Osos, and will remove a significant and ongoing source of environmental degradation.

It must also be noted that without the wastewater project, and specifically the recovery and reuse of recycled water included in it, there is no possibility that Los Osos can solve its water supply issues, either now or in the future. Placing recycled water at the Broderson site, replacing groundwater pumping for irrigation with recycled water, and mandating interior plumbing retrofits are indispensible elements of Los Osos' water future that are provided by the wastewater project. In addition, technical studies completed by the wastewater project clearly show that imported water options are not financially feasible for the community; managing existing groundwater supplies is the only viable option.

The County of San Luis Obispo is not a water purveyor for the community. Water is supplied by Golden State Water Company, the Los Osos Community Services District, S&T Mutual Water Company, and individual on-site wells. Consequently, the County has no direct authority to control groundwater pumping, set water rates, or establish penalties for excessive water use. Never-the-less, the County has and will continue to use all of its other authorities to positively impact the issue of water availability in Los Osos. Examples of County efforts include:

- The County has voluntarily remained involved in the current groundwater litigation between the water purveyors in order to positively influence the outcome for the citizens of Los Osos,

- The County has used its land use authority to adopt water efficient landscape ordinances (attached),

- The County has used its land use authority to adopt a retro-fit upon remodel ordinance, requiring the entire structure to upgrade to water efficient technologies (attached),

- The County has used its land use authority to adopt a retro-fit upon sale ordinance, requiring the entire structure to upgrade to water efficient technologies (attached), and

- The County has used its land use authority to require new development to retrofit enough existing homes and businesses to save twice the amount of water the new development would use (attached).

These previous actions demonstrate that the County is committed to using its authority to accomplish the necessary changes in the water use and supply equation in Los Osos.

3. Water Conservation Program

The focus of the water conservation program is to reduce seawater intrusion in Los Osos. Therefore, the conditions of approval describe a Program that includes elements that reduce pumping by reducing overall water use through mandated retrofits, provide recycled water in place of water pumped from the lower aquifer, provide a means to monitor water use, and provide for ongoing coordination with water purveyors.

The Water Conservation Program will comply with existing State policy contained in Section IX(C) of *Policy for Implementing the Clean Water State Revolving Fund for Construction of Wastewater Treatment Facilities*, *SWRCB*. Key Water Conservation Program elements in this policy are:

1. Water Survey Programs For Single-Family Residential And Multi-Family Residential Customers
2. Residential Plumbing Retrofit
3. System Water Audits, Leak Detection And Repair
4. Metering With Commodity Rates For All New Connections And Retrofit Of Existing Connections
5. Large Landscape Conservation Programs And Incentives
6. High-Efficiency Clothes Washing Machine Financial Incentive Programs
7. Public Information Programs
8. School Education Programs
9. Conservation Programs For Commercial, Industrial, And Institutional Accounts
10. Wholesale Agency Assistance Programs
11. Retail Conservation Pricing
12. Conservation Coordinator
13. Water Waste Prohibition
14. Residential Ultra-Low Flush Toilet Replacement Programs

1k. This approval authorizes . . . a water conservation program allowing a maximum water usage of 50 gallons per day / person for indoor water usage.

Condition 1k establishes the Water Conservation Program as part of the proposed project, and establishes a basic standard of 50 gallons per day per person indoor use. The indoor use standard is identified because it provides a direct nexus to the wastewater project: water used indoors directly impacts the size and operation of the collection system, treatment plant, and recycled water components of the Project.

6. Tertiary Treatment. The treatment plant shall provide Disinfected Tertiary Recycled Water as defined at Section 60301.230 of Title 22 of the California Code of Regulations, which means a filtered and subsequently disinfected wastewater that meets the following criteria:

(a) The filtered wastewater has been disinfected by either:

(1) A chlorine disinfection process following filtration that provides a CT (the product of total chlorine residual and modal contact time measured at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or

(2) A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque-forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration.

(b) The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.

Prior to providing tertiary treated water for agricultural uses the applicant shall develop a Recycled Water Management Plan for Agricultural Re-use. The use of tertiary treated water shall be consistent with resource protection strategies including but not limited to those designed to protect on and off site soils, and surface and groundwater resources through the use of appropriate site-specific management practices. The applicant shall consult with technical resource providers such as the University of California Cooperative Extension and USDA Natural Resources Conservation Service. The Plan shall be reviewed and approved by the Director of Planning and Building in consultation with the Agricultural Commissioner's Office prior to providing tertiary treated water for agricultural uses.

Condition 6 establishes that the project will provide tertiary recycled water. The specifications are from Section 60301.230 of Title 22 of the California Code of Regulations in order to clearly state that the recycled water is available for a variety of reuse options. Although the water code allows recycled water to be used on agricultural crops with no restrictions, we felt that a management plan is appropriate based on EPA guidelines to address any potential issues, such as:

- Salinity Management
- Trace Elements
- Chlorine Residual
- Nutrients
- System Reliability
- Site Use Control
- Monitoring Requirements
- Runoff Controls
- Marketing Incentives
- Irrigation Equipment

Depending on the rate of hookups after project completion, and the rate at which recycled water is placed at the Broderson site, water for agricultural use would be available from 0-3 years after project start-up. However, the Recycled Water Management Plan is an important part of the negotiations with farmers. Therefore, we expect to have the Management Plan completed prior to operation of the wastewater facility.

97. Disposal of treated effluent shall be reserved for the following sites/uses in the Los Osos Groundwater Basin:
a. Broderson (not to exceed 448 AFY on an average annual basis),
b. Urban re-use within the urban reserve line (as identified in the Effluent Re-Use and Disposal Tech Memo, July 2008),
c. Agricultural re-use overlying the Los Osos Groundwater Basin,
d. Environmental reservations (not less than 10% of the total volume of treated effluent), and
Total agricultural re-use shall not be less than 10% of the total treated effluent. Disposal shall be prioritized to reduce seawater intrusion and return/retain water to/in the Los Osos groundwater basin. Highest priority shall be given to replacing potable water uses with tertiary treated effluent consistent with Water Code Section 13550.
No amount of treated effluent may be used to satisfy or offset water needs that result from non-agricultural development outside the Urban Reserve Line of the community of Los Osos.

Condition 97 describes where the recycled water generated by the project will and will not be used:

- The amount needed to offset current septic flows to the upper and lower aquifer is placed at Broderson (448 acre feet).
- (See condition 101 for the 33 acre feet to be placed at Bayridge)
- Urban reuse at the Park, schools and golf course is specified (see attached section from the Effluent Re-Use and Disposal Tech Memo, July 2008)
- Agricultural reuse over the basin (see attached map of basin boundaries)
- A reservation of not less than 10% for environmental uses (so far only Bayridge would fall into this category). Also note that this is a lower limit; if additional water is needed as a result of the monitoring required in condition 87, it would be provided.

The next paragraph sets a lower limit for agricultural reuse at 10%, to ensure that we maintain a viable program. This paragraph also describes how we will prioritize recycled water use, focusing first on those elements that best reduce seawater intrusion.

The last paragraph will ensure that no recycled water is used outside of the URL for new development, responding to our concern that development outside the URL might otherwise use or leverage recycled water for growth outside the urban boundary.

99. Within one year of adoption of a due diligence resolution by the Board of Supervisors, electing to proceed with a wastewater project, a water conservation program shall be developed by the applicant in consultation with the local water purveyors within the prohibition zone for the community of Los Osos, that meets the goal of 50 gallons per day / per person for indoor use. The applicant shall provide 5 (five) million dollars of funding towards a water conservation program for indoor water conservation. Incentives shall be provided to homeowners and other property owners who install conservation measures within the first year.

Condition 99:

1) Specifies a time frame for the Water Conservation Program (that is, those elements and efforts of water conservation that are not project components to be implemented as part of the project description and/or other specific conditions of approval). The due diligence resolution, required by AB2701, commits the County of San Luis Obispo to implementing the Project. It also allows the County to start collecting assessments, thereby providing the funding foundation for the project. Within one year after the resolution is adopted and provides the necessary funding, the County will have the remaining details of the Water Conservation Program developed and can begin full implementation. We expect the basic elements of the Program will be those specified in the Conditions of Approval, plus those elements included by the SWRCB's SRF program (listed above), as well as any additional items that are appropriate for Los Osos. The condition requires that we work "in consultation with the local water purveyors within the prohibition zone" so the scope of the Program will depend to some degree on the role(s) the water purveyors choose.

2) Provides a conservation goal for indoor water use (50 gallons per day / per person, repeating the project description)

3) Provides a funding level to assist homeowners with the cost of indoor retrofits that are required in condition 103 below.

4) Requires the funding to be distributed through an incentive program that encourages retrofits within the first year after the conservation program goes into effect, which would be before the wastewater project goes on line.

101. The applicant shall utilize the existing Bayridge leach field (APN 074-491-033) to dispose of approximately 33 acre feet per year of treated effluent upon

decommissioning of the existing leach field and connection to the community sewer system. The applicant shall consult with the Los Osos Community Services District (LOCSD) prior to the design phase of the project regarding use of said facilities to ensure all their concerns are addressed.

Condition 101 adds the existing Bayridge leachfield to the list in condition 97 above in order to preserve existing groundwater flows in that part of the Willow Creek drainage.

103. Prior to individual property connections to the waste water system, each property owner shall provide verification to the satisfaction of the Planning Director that all toilets, showerheads and faucets have been replaced with high efficiency versions of the same.

Condition 103 provides the technology based foundation of the water conservation program. By retrofitting existing properties with the specified fixtures, which require no behavior changes on the part of building occupants, we expect to meet or fall below the 50 gpd/person standard. Consequently, other elements of the conservation program will focus on reducing water use further by including additional fixture changes (e.g., front loading washers, hot water circulators), public education, and outdoor water use reductions (grey water systems, water efficient landscaping, etc..).

108. Prior to individual property connections to the wastewater treatment project, each property owner shall provide verification to the satisfaction of the Public Works Department (in consultation with the Planning Director) that a water meter meeting American Water Works Association (AWWA) standards, and approved by the water company serving the individual property, has been installed or is existing on the connection site. A water meter shall be installed on each legally established residential / commercial unit prior to connection to the wastewater treatment project. Water usage information shall be made available to the sewer authority on a quarterly basis or on a schedule agreed to by the water purveyors and the County to verify the water savings derived from the water conservation program.

Condition 108 provides for two important components of the Water Conservation Program:

1) Existing residences connected to the S&T Mutual Water Company do not have water meters. This not only prevents the use of tiered water rates to encourage conservation, but would also prevent the wastewater authority from implementing tiered wastewater rates as well. (Note that wastewater flows are determined by monitoring wet season water use, when outdoor use is non-existent or at a minimum.) This condition would ensure that all connections to the wastewater project have proper water meters that can be used to set tiered wastewater and water rates to better encourage conservation.

2) This condition also requires that individual water use information be made available to the wastewater authority. As a condition of hook-up to the wastewater system, each property would be required to grant the wastewater authority access to their water use information.

This condition will allow the County to monitor the success/status of the water conservation program by collecting accurate water and wastewater use information. Based on this information, the County can implement conservation billing for wastewater services, focus conservation program elements, and keep the public and other agencies informed about the status of the project.

Attachments:

- Implementation and Timing of Conditions of Approval Table
- SRF Program Water Conservation Requirements
- Groundwater Basin Map
- Effluent Re-Use and Disposal Tech Memo, July 2008 (part)
- Coastal Zone Land Use Ordinance Section 23.04.184 (Water Efficient Landscape Ordinance)
- Los Osos Groundwater Basin Retrofit Ordinances:
    - Title 19
    - Title 8

Notes for the LOSG Basin Balance Charts

Assumptions/implications:

1. **Basin balance/sustainability** The LOSG Plans are designed to maximize the likelihood of basin balance/sustainability by emphasizing measures that have the most direct benefits on seawater intrusion (SWI) in the lower aquifer (reduced pumping) while not causing SWI in the upper aquifer. Shifting pumping to the upper aquifer, as Gus Yates of HydroFocus points out, doesn't increase total basin yield and may cause seawater intrusion in the upper aquifer. LOSG Plans, like all plans, require an effective SWI monitoring plan and a contingency plan. If seawater intrusion is detected with the LOSG Plans, pumping can be shifted, as it is now, between upper aquifer lower aquifers. Also, development of wells located further inland is a prudent course of action.
2. **Potential reduction from conservation is 25% in the Western Compartment** A conservative estimate of total basin production in the Western Compartment is 2100 AFY. Conservation in the LOSG Plans is assumed to reduce water use by 500 AFY (less than 25%). Furthermore, the program, itself, targets a 30% reduction (630 AFY), so a margin of safety is built into estimates, to account (in part) for uncertainties related to outdoor and Class II water use reduction.
3. **A 500 AFY margin of safety is needed for basin balance** Due to substantial uncertainties in basin safe yields and budgets, as pointed out by Gus Yates of Hydrofocus, a generous margin of safety in yields is warranted. Plans to pump much more from the upper aquifer and major changes in recharge regimes with the project add to yield uncertainties. The chart applies a 17% margin rounded to an even 500 AFY. This is 17% of the 3200 AFY current safe yield (per Cleath-Harris Geologists, Inc., ISJ TM, 2009). (Note: The 500 AFY margin can only be achieved with conservation and/or LID (supplemental water). Recycled water is not a supplemental source because it originates within the basin and simply replaces water removed with the project.
4. **900 AFY of reduced pumping from the lower aquifer will stop seawater intrusion** Per the ISJ TM "Flow Model Conversion and Urban Area Yield Update," (Cleath-Harris Geologists, Inc., 2009), the safe yield for the lower aquifer is 655 AFY for the Western Compartment and 1670 AFY for the upper aquifer under the current condition scenario. This would require shifting about 1000 AFY to the upper aquifer. However, actual purveyor production for the last 4 years is about 100 AFY less than the purveyor safe yield (per the ISJ TM). Thus, these charts use 900 AFY of reduced pumping as a starting point for stopping seawater intrusion.
5. **LID provides 200 AFY of recharge** A CSU Monterey Watershed Institute graduate class estimated that from about 70 to 600 AFY of run off from roofs in Los Osos could be captured and infiltrated for groundwater recharge. These charts assume a conservative 100 AFY of water can be captured and infiltrated on-site, and they add 100 AFY for public commercial spaces, such as parking lots. This amount will need to be verified, but the 200 AFY of LID in the LOSG Plans are not needed for basin balance.
6. **300-500 AFY of water is available for ESHA in the LOSG plan with the LOWWP** The 700 AFY of recycled water for urban reuse and agricultural exchange would allow 300 AFY of exchange water (e.g., water from the upper aquifer for Willow Creek offset by recycled water supplied to large properties in the area). The 300 AFY assumes none of the 200 AFY of water from LID goes to ESHA, and the 500 AFY assumes all of it goes to ESHA.
7. **Broderson leach fields are not needed in the LOSG Plan with the LOWWP** Los Osos water purveyors are (or soon will be) shifting more pumping from the lower aquifer to the upper aquifer to reduce seawater intrusion. The safe yield estimate for the upper aquifer under current conditions, per the 2009 ISJ TMs, is about 1670 AFY and the safe yield for the lower is 655. This assumes about 900 AFY or so of pumping can be shifted to the upper aquifer safely to stop (or almost stop) SWI in the lower aquifer. Since the EIR states that Broderson will replace about 450 AFY of flows to the upper and lower aquifers (of the 500 AFY removed with septic systems), it can be assumed that reducing upper aquifer pumping by 450-500 AFY (to about 1200 AFY) would alleviate the need for Broderson—if pumping from the lower aquifer did not increase (i.e., remained about 600 AFY). The LOSG Plan (With LOWWP) allows 900 AFY of reduced pumping from the lower aquifer, while maintaining upper aquifer pumping at current levels (about 700 AFY). Thus, it should alleviate the need for Broderson. Gus Yates points out that the ISJ TM underestimates SWI and fails to note substantial uncertainties in basin safe yields. However, the LOSG Plan reduces upper aquifer pumping by the 450 AFY Broderson would replace, in addition to about another 350 AFY. The two Purveyor/LOWWP Plans (With Project)—w/ ag reuse and w/ag exchange—require 450 and 700 AFY of pumping to be shifted with Broderson at 450 AFY. Neither provides water for ESHA, and both assume Broderson will work. If Broderson doesn't work, both plans may cause seawater intrusion in the upper aquifer. Given the adverse impacts of Broderson leach fields on resources (ESHA and energy consumption), and the multiple benefits of conservation, the LOSG Plan appears to be more prudent. As mentioned, a good monitoring program and contingency plan is essential to any plan.

Basin Balance (2/2010 Draft)

(w/ Ag Exchange)

LOSG Plan
(Current Conditions)

~ Water from ~

LID recharge (200)
Conservation (500)
Shifted to upper aq. (400)

~ Water to ~

Creeks
Springs (same)
Estuary

BALANCED*
(200 AFY added margin of safety)

- Stops SWI in lower aquifer
- Does not cause SWI in upper aquifer
- Maintains flows to ESHA
- Assumes 900 AFY reduction stops SWI

Purveyor Plan
(Current Conditions)

~ Water from ~

Conservation (100)
Shifted to upper aq. (800)

~ Water to ~

Creeks
Springs (less)
Estuary

Out of Balance*
(400 AFY deficit)

- May stop SWI in lower aquifer
- May cause SWI in upper aquifer
- May cause reduction in flows to ESHA
- Assumes 900 AFY reduction stops SWI

LOSG Plan
(With Project)

~ Water from ~

LID recharge (200)
Conservation (500)
Ag Exchange or Urban reuse (700)
Shifted to upper aq. (0)

~ Water to ~

Creeks (same—
Springs 300-500
Estuary AFY)

Treatment (700)

BALANCED*
(200 AFY added margin of safety)

- Stops SWI in lower aquifer
- Does not cause SWI in upper aquifer
- Maintains flows to ESHA
- May avoid use of Broderson if 400 AFY of ag ex/urban reuse is used to reduce upper aquifer pumping

LOWWP/Purveyor Plan
(With Project)

~ Water from ~

Conservation (100)
Broderson (450)
Ag Exchange or Urban reuse (350)
Shifted to upper aq. (450)

~ Water to ~

Creeks (much
Springs less—0
Estuary AFY)

Treatment (800)

Out of Balance*
(400 AFY deficit)

- Stops SWI in lower aquifer
- Does not cause SWI in upper aquifer
- Does not maintain flows to ESHA
- If 350 AFY of ag ex/urban reuse is used for ESHA, SWI is not stopped or plan causes SWI in upper aquifer

* Assumes a 500 AFY margin of safety in basin safe yield (2700 vs. 3200 AFY) to account for uncertainties. Also see "Notes for the Basin Balance Charts."

EXHIBIT "C"

but not surprising results occur. For example large storage declines during dry periods in the Los Osos Creek subarea when pumping there is increased, or seawater intrusion does not slow at the rate expected, or the reduction in septic tank seepage does not slow at the rate expected, etc.

Seawater Intrusion

The model calibration provides reasonable results as noted above. However, there is likely some uncertainty regarding the exact extent of the landward movement of seawater intrusion under predictive scenarios. It is important to note that when making a comparison between predictive model simulations that the relative difference between the extent of seawater intrusion that is important for evaluating basin management alternatives rather than the absolute value of the extent of seawater intrusion or specific Chloride concentrations at any one location due to model limitations discussed above.

Given the limitations of SEAWAT, the Recommendations discussed below include suggestions for evaluating dry period, seasonal and intermittent stream conditions by updating the current model using monthly transient stress periods.

Safe Yield Estimates

The safe yield estimate for the Urban Area of 3,200 afy (CHG, 2009a) is a reasonable long term average estimate, but with limitations discussed above regarding the uncertain response of the aquifers during extended dry periods. It is suggested that a +/- value be added to that estimate based on model uncertainty.

The SEAWAT limitations regarding the RIV module to simulate leakage to the aquifer have been address above, and the additional recharge under the scenario of expanded pumping in this area is reasonable due to consideration of this limitation by CHG. An uncertainty range could also be added to the Los Osos Creek subarea safe yield estimate of 3,150 afy (CHG, 2009b) for the same reasons. Additional recharge from Los Osos Creek is an important component of this estimate. Improvements in model accuracy could be made through a monthly transient calibration of the existing SEAWAT model using the updated code with STR package capability. Reporting on an improved version of the model should still include a section on uncertainty.

EXHIBIT "C"

Conclusions

The current SEAWAT model and results regarding seawater intrusion and safe yield provides usable results on which to base near-term changes in pumping distribution to mitigate seawater intrusion (CHG, 2009a, b). However, it is suggested that uncertainty values should be assigned by CHG to the model results given the model limitations to assist decision makers in their choice of action and any additional measures that should also be considered. Our involvement with the USGS in other basins indicates they include, and recommends others include, a limitations and uncertainty section in model documentation (W. Danskin, USGS Research Hydrologist, 2009). SEAWAT is an appropriate model code for the Los Osos basin for evaluation of the average groundwater basin budget (including basin and subarea yields), the extent of seawater intrusion, and for use in evaluating the relative effects of development and changes in basin management or climate variability.

Recommendations

Although recommendations were not requested as part of this review, they are included in the text above and summarized below.

1) Add uncertainty values to seawater inflow extent and rate, and safe yield estimates in CHG (2009 a,b) and future model documentation, memos, etc.
2) Calibrate SEAWAT in monthly transient mode and use the STR package to represent Los Osos Creek. Use a long period of record that includes the critical dry period for the region. Repeat the same hydrologic period for predictive simulations.
3) Continue to review climate change literature and determine if a comprehensive scenario regarding climate change should be run using an updated version of the model.
4) Write up the Yates preprocessor used to estimate deep percolation to the saturated flow model (SEAWAT, MODFLOW, etc) including diagrams, screen capture or other method to show how model the works, include the source of model input data, what variables are usually changed for predictive runs and which variables are most sensitive. This preprocessor provides significant input to the flow models and more complete information is needed.
5) Additional model documentation is needed on the SEAWAT model for the Los Osos Creek Basin including assumptions, maps of hydraulic property distributions by layer, stream input data, reference to the unsaturated flow preprocessor and changes to input for model simulation, and other details sufficient for a complete understanding of the model.
6) For the benefit of users of model results, future reviewers or model users it is suggested that a summary of Los Osos models and related documents be prepared. This documentation should include, at a minimum, a table with; a) the model code used, b) whether transient or steady state, c) period simulated (calibration and prediction) and stress period length, d) if Yates preprocessor or other method used to estimated deep

EXHIBIT "C"

percolation, f) if transport, which species were simulated, and g) date and title of key documentation. This would have saved the reviewer a lot of time in trying to determine relevance and differences between these models listed below.

- Yates and Weise,1988
- Yates and Williams, 2003
- URS, 2000
- CHG 2005
- CHG 2009a, b

REGISTERED GEOLOGIST
PETER M. PYLE
No. HG605
Certified Hydrogeologist
STATE OF CALIFORNIA

EXHIBIT "C"

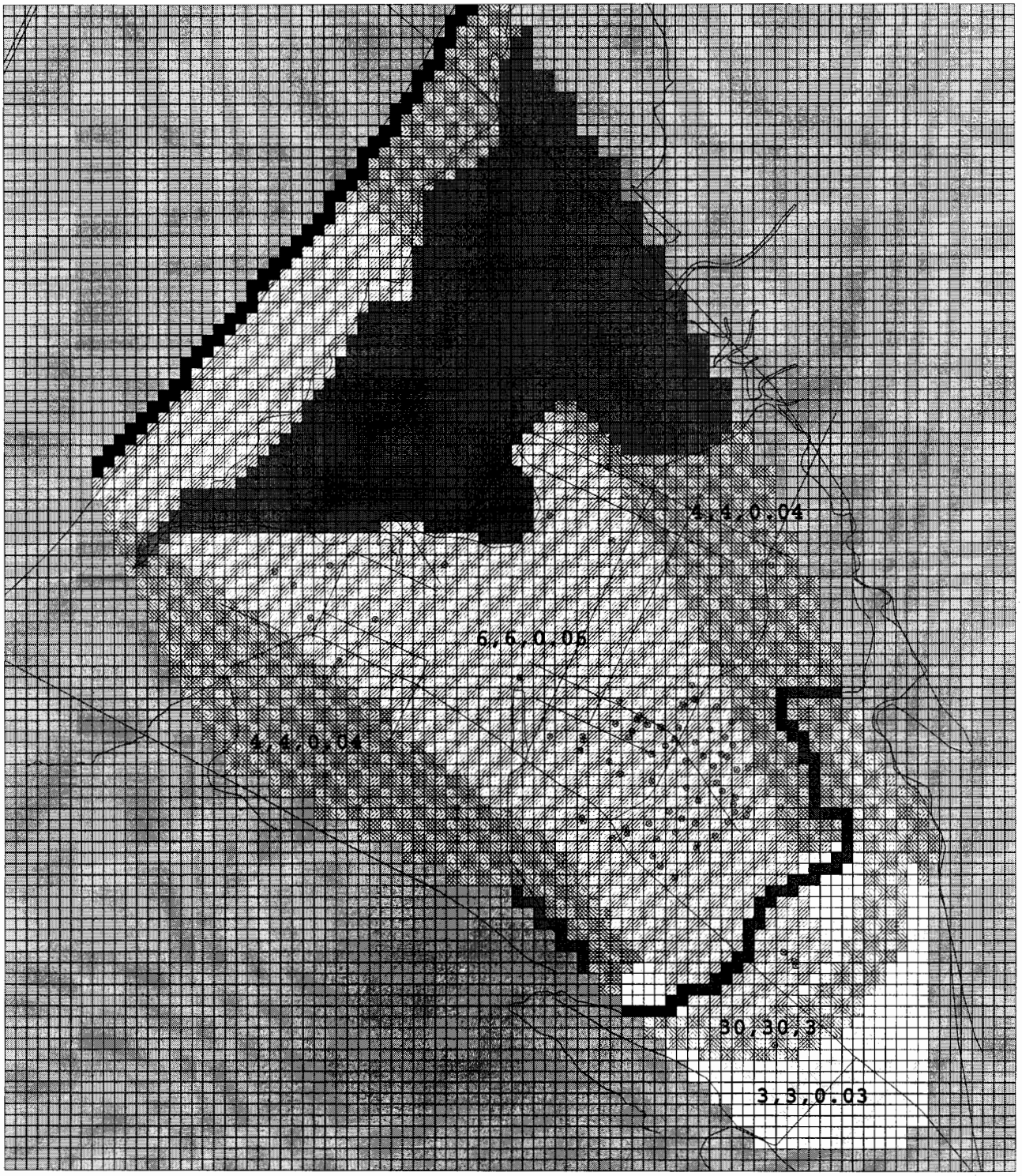

Figure 1. Horizontal Hydraulic Conductivity - Layer 1

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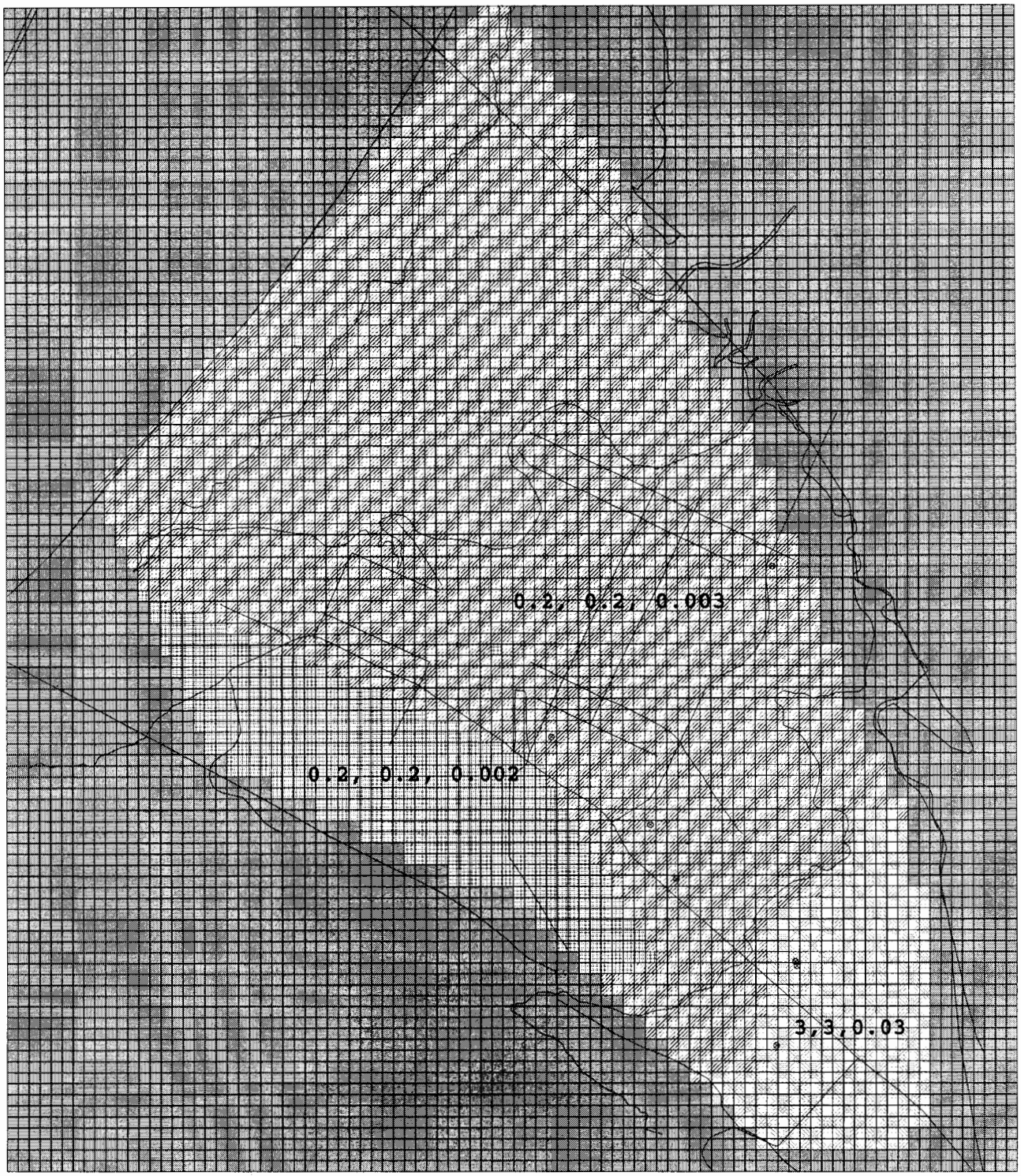

Figure 2. Horizontal Hydraulic Conductivity - Layer 2

EXHIBIT "C"

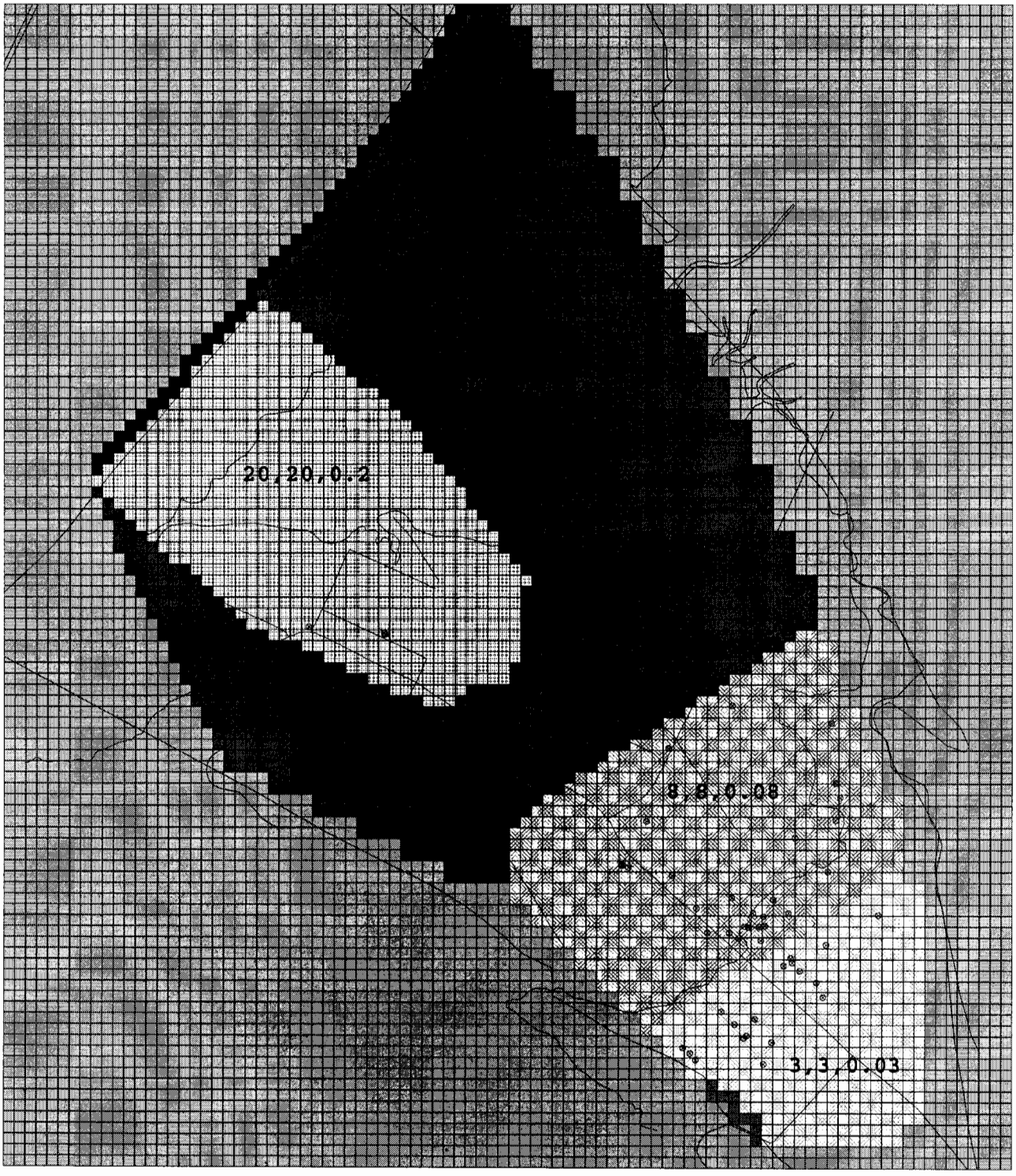

Figure 3. Horizontal Hydraulic Conductivity - Layer 3

EXHIBIT "C"

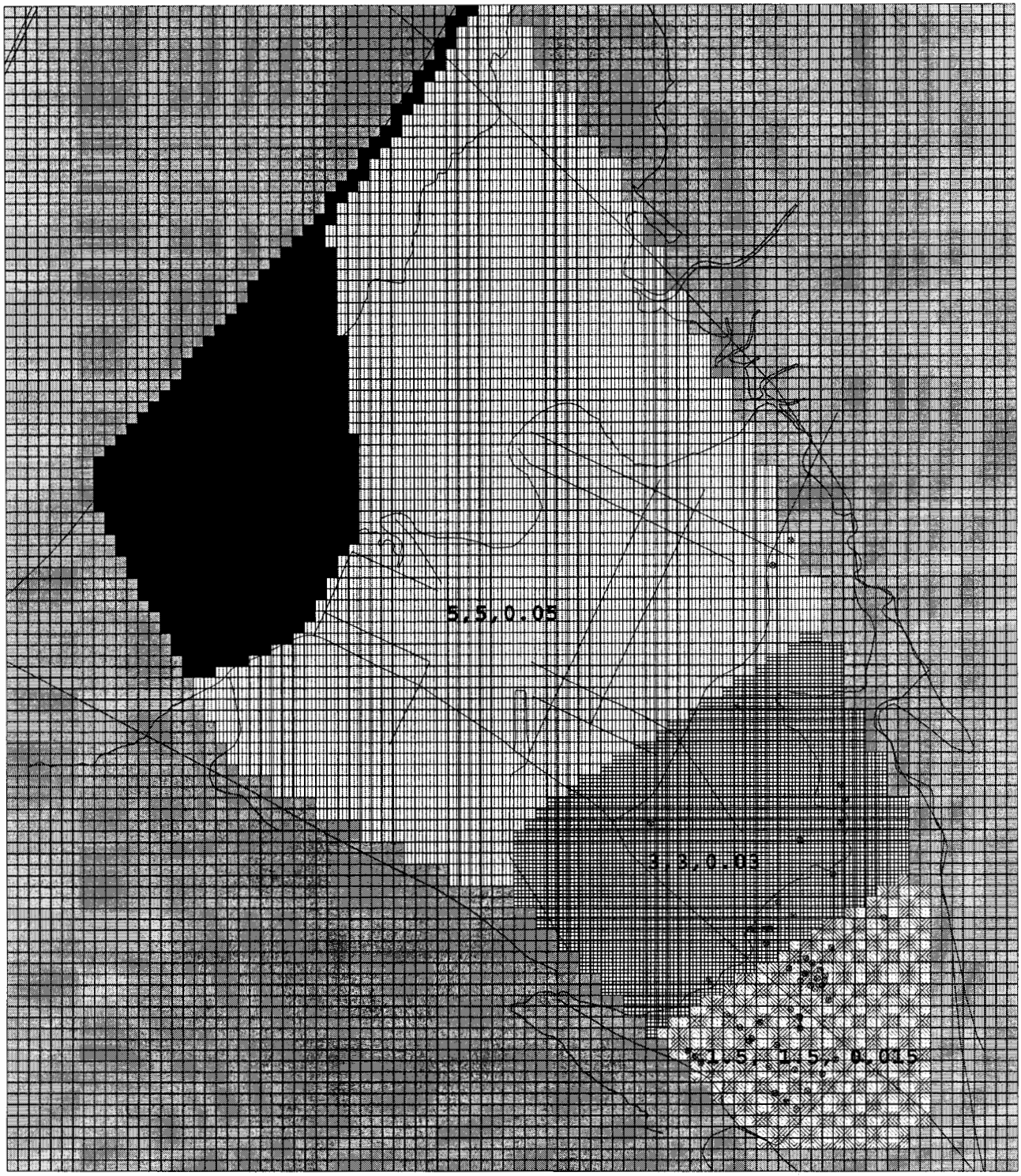

Figure 4. Horizontal Hydraulic Conductivity - Layer 4

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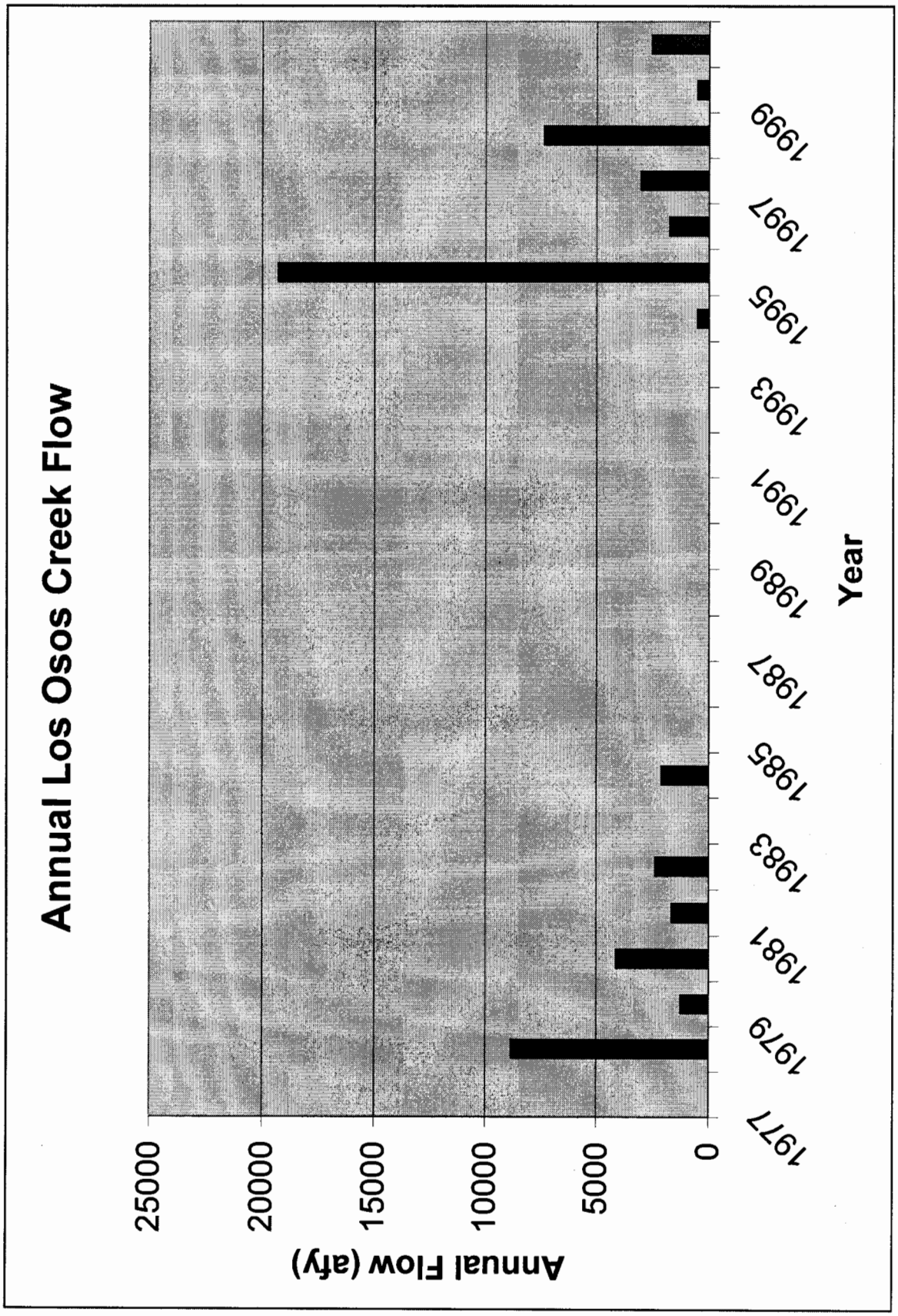

Figure 5. Annual Los Osos Creek Flow (1978-2002)

STATE OF CALIFORNIA – NATURAL RESOURCES AGENCY ARNOLD SCHWARZENEGGER, *Governor*

CALIFORNIA COASTAL COMMISSION
CENTRAL COAST DISTRICT OFFICE
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July 15, 2009

Paavo Ogren, Director
San Luis Obispo County Public Works Department
County Government Center, Room 207
San Luis Obispo, CA 93408

Subject: **Proposed Los Osos Wastewater Project**

Dear Mr. Ogren:

We have been following the evolution of issues surrounding the Los Osos wastewater treatment project with great interest and some consternation. We have also, as you know, provided input and recommendations on the project, most recently through our EIR comments as well as conference calls with you and your staff. As the review by the Planning Commission progresses we are being made aware of additional issues that need to be addressed by the County before the matter comes to the Commission (we think it safe to assume the matter will be appealed to the Commission by one or more parties) – issues that have been brought to our attention by members of the community, our own improved understanding of the complex, changing circumstances affecting the project with coastal resource implications, and other public agencies. Some of these issues are new, but most are issues which we have previously identified that are evolving as more information and deliberations are brought to bear on the project. As you know, during the course of the Commission's meeting in San Luis Obispo on July 8th and 9th, we received numerous substantive public comments from Los Osos residents regarding the proposed wastewater treatment project. Some of the comments were focused on issues on which we have already commented, by letter and numerous discussions. It appears that some of these are being addressed in a positive manner by the County's Planning Commission, which is continuing to hold hearings on the project. For example, the Planning Commission has tentatively conditioned the project to include important design changes such as tertiary treatment, fusion welded pipes in areas of high groundwater, and relocation of the treatment plant itself from Tonini Ranch to the Giacomazzi site.

In response to public comments in San Luis Obispo earlier this month, the Executive Director responded to several speakers by telling the Commission, the County and the public that we would be sending a supplementary letter to the County spelling out our additional concerns about several issues that we strongly hope will be addressed by the County, either by the Planning Commission or the Board of Supervisors. In subsequent discussions with individual commissioners, it became clear that there is great concern among them, and staff, that several very significant issues may not be adequately addressed at the County level, ultimately leaving to the Commission the question as to how they should be addressed. In particular, given the testimony at public comment during the July meeting, the information presented, and ensuing discussions between commissioners and the Executive Director, it appears several critical design issues that warrant changes to the proposed project are still a matter of debate. In order to avoid an unnecessary impasse when this matter arrives at the Commission we urge the County to address the following issues in addition to the others we have previously identified.

We think that potential sea water intrusion into the system and the basin's groundwater is an issue that needs to be addressed as an integral component of the project's design. Failure to address this issue could be viewed by the Commission as a fatal omission. At the July hearing, we were presented compelling testimony and information that indicates that the rate and extent of sea water intrusion into the lower aquifer in Los Osos constitutes an imminent crisis that warrants immediate attention. We are of the opinion that dealing with this issue must not be delayed until some future date after the waste collection, treatment and disposal project is operational. The water basin is in severe overdraft and cannot afford to export significant portions of its inflow for disposal outside its boundaries. We understand that an explanation for postponing this issue for some unspecified length of time is that partial recharge at a single disposal site in the basin and minimal conservation measures will be adequate to halt advancing sea water levels. However, we remain doubtful that this assumption is correct, and we are concerned that continued sea water intrusion into the basin threatens to render the aquifer completely unusable as a potable water supply and could impact the reliability of the wastewater treatment system itself. We disagree that seawater intrusion is an issue that should be addressed independent of the sewer project. Sensible reuse and disposal of treated water within the basin can have a significant effect in slowing or reversing seawater intrusion. Additionally, steps to protect the Community's drinking water supply can and should be taken in conjunction with this project and not relegated to some future arrangement with water purveyors. We recognize this project cannot entirely resolve the seawater intrusion problem, however, if properly designed and built, this project can help. We think there are multiple benefits to be derived from addressing seawater intrusion in the context of this project.

Similarly, we are also concerned about and strongly urge the County to build into the project sensible and doable wastewater reuse and disposal components. While we sympathize with the County's desire to spread the costs of groundwater recharge between the private water purveyors and future development, we strongly encourage design of a project that returns flows to the basin at project start up, particularly because it appears that multiple discharge options exist over the basin. As previously indicated, one of those feasible options is agricultural re-use, which has the added benefit of reduced pumping from the aquifer. Other feasible options include urban irrigation, residential re-use (purple pipe), constructed wetlands, disbursed leach fields and on-basin spray fields. A continued focus on spray disposal on the Tonini prime soils agricultural lands outside the basin is in our view inappropriate for reasons we previously communicated to the County as well as what we said above. All these reuse/recharge alternatives appear feasible and would more closely mimic current, diffuse discharge patterns, including those that support sensitive habitats.

Should future negotiations with water purveyors result in greater participation or additional approaches to slowing or reversing seawater intrusion into the basin's groundwater, these can be included by way of future permit amendments if necessary. For now, though, we strongly recommend that the project include such measures from the onset. We think the system needs to be designed to address the groundwater intrusion and recharge issues, and this element of the project ought not be delayed until some future arrangements with water purveyors can be achieved.

The County's LCP policies call for balancing of groundwater basins and protection of watersheds. A project that does not fully return tertiary treated effluent to the basin would be inconsistent with applicable LCP policies (e.g., LCP Coastal Watershed Policies 1, 2, 5, and 11). We also encourage timely implementation of strong, effective water conservation measures, by both the County and private water purveyors, that will reduce water extraction, thereby reducing pressure on the lower aquifer. Irrespective of the rather limited project goals and objectives identified in the EIR, seawater intrusion is an adverse impact that is inextricably linked to this project, and as such, must be fully addressed and mitigated.

Finally, we understand that the goal of minimizing sludge production to the maximum extent practicable has not been identified as a priority in the evaluation of alternative collection systems and treatment technologies. We recommend that the mitigation of this particular project impact be reflected as a high priority in the selection of preferred collection and treatment technologies and that the County ensure that the methods chosen are the best ones designed to produce this outcome.

We hope that these comments are useful to the County as the project moves through the local review processes. These comments are intended to help inform the decision making process at the local level and we hope they are taken into account and addressed before the project is approved and appealed to the Commission. As you know, this project is a major public works undertaking for which it is incumbent on the County and all responsible entities to thoughtfully consider options and project permutations that can maximize its effectiveness in promoting the public welfare and protecting coastal resources. In our view this means that the wastewater and groundwater problems in Los Osos must be addressed holistically and not piecemealed. Sound land and water use planning and effective public policy implementation call for such an approach. As the Executive Director said at the July meeting, we are trying to convey our concerns to the County in a timely manner in order to avoid or minimize conflicts later in the process. Please feel free to contact us if you have any questions or concerns and we look forward to continuing to work in a collaborative manner with the County to achieve a well designed, approvable, long overdue wastewater treatment system for Los Osos.

Sincerely,

Dan Carl
Central Coast District Manager

cc: Bruce Gibson, Chair, Board of Supervisors
Frank Mecham, Vice-Chair, Board of Supervisors
Khatchick Achadjian, Board of Supervisors
Adam Hill, Board of Supervisors
James Patterson, Board of Supervisors
Kami Griffin, Planning Department
Mark Hutchinson, Public Works Department

STATE OF CALIFORNIA – THE RESOURCES AGENCY

ARNOLD SCHWARZENEGGER, *Governor*

CALIFORNIA COASTAL COMMISSION
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89 SOUTH CALIFORNIA ST., SUITE 200
VENTURA, CA 93001
(805) 585-1800

MEMORANDUM

FROM: Jonna D. Engel, Ph.D.
Ecologist

TO: Jonathan Bishop
Coastal Program Analyst

SUBJECT: Los Osos Wastewater Treatment Project

DATE: May 19, 2010

Documents Reviewed:

Weir, Eric and Kate Ballantyn (Environmental Scientists, San Luis Obispo County). March 23, 2010. General Biological Survey and Habitat Assessment for the Los Osos Wastewater Project – Giacomazzi & Andre Sites.

Michael Brandman Associates. November 14, 2008. Delineation of Jurisdictional Waters and Wetlands for the Los Osos Wastewater Project. Attachment G of Appendix G of the Los Osos Wastewater Project, Environmental Impact Report.

Morro Group, Inc. June 18, 2004. Los Osos Wastewater Disposal Project Lupine Street Pump Station Los Osos, California Wetland Delineation Report.

Morro Group, Inc. September 8, 2004. Los Osos Wastewater Disposal Project Treatment Plant Area Los Osos, California Wetland Delineation Report – Potential Wetland Constraints Mapping).

Morro Group, Inc. August 9, 2004. Los Osos Wastewater Disposal Project Lupine Street Pump Station Los Osos, California Wetland Delineation Report.

Morro Group, Inc. July 1, 2004. Los Osos Wastewater Disposal Project Lupine Street Pump Station Los Osos, California Wetland delineation Report.

Morro Group, Inc. June 18, 2004. Los Osos Wastewater Disposal Project 7th through 13th Streets Pump Station Los Osos, California Wetland Delineation Report.

Morro Group, Inc. June 7, 2004. Los Osos Wastewater Disposal Project 4th Street at Pismo Avenue Area Los Osos, California Wetland Delineation Report.

Construction Staging

Walker

The proposed construction staging site is located north of Pismo Avenue, east of 18th Street, west South Bay Boulevard, and south of Paso Robles Avenue, near the proposed East Paso pump station, on 6-acres owned by Mr. Walker. The County selected this property to serve as a construction staging center (with an expected duration of approximately two years) because it does not support any sensitive plant communities, plants, or animals. The Walker property is currently degraded from years of high impact uses such as farming and housing animals. The majority of the site is bare sand and non-native grasses that are bounded by scattered native and non-native shrubs including invasive pampas grass, *Cortaderia selloana*.

The Walker site, while significantly degraded, is made up of Baywood fine soils, and therefore, as described above, is ESHA. However, use of this site will avoid impacting more valuable ESHA elsewhere and thus, the Walker site is a good choice for construction staging for a wastewater treatment project such as this, within the context of Los Osos and the LCP. In any case, once the County has completed construction of the wastewater treatment project, the site must be returned to pre-construction conditions or better.

Conclusion

The primary reason for the Los Osos Wastewater Treatment Project is to reduce harmful discharges to Morro Bay and the Los Osos groundwater basins. The Regional Water Quality Control Board (RWQCB) has determined that a wastewater treatment project is necessary to protect and restore the water quality of the Los Osos groundwater basin and the Morro Bay National Estuary. The current design for the proposed Los Osos Wastewater Treatment Project is intended to address and resolve this significant and longstanding environmental degradation issue, and its importance should not be underestimated. I have visited and reviewed the County's proposed locations for the various components of the Los Osos Wastewater Treatment Project including the Giacomazzi and Andre Properties where the main treatment plant and access road are proposed; Los Osos Creek Bridge where pipelines are proposed; the proposed pump station sites (Sunny Oaks, Mid-Town (Tri-W), Solano, Lupine, West Paso, Baywood, East Ysabel, East Paso, and Mountain View); two leach field sites (the existing Bay Ridge site and the proposed Broderson site); and the proposed Walker construction staging site. I believe that the County sited, or has subsequently sited the project components in the least environmentally damaging feasible locations. The County has gone to great lengths to avoid ESHA where possible and to limit ESHA impacts to the least possible footprint where ESHA impacts have been unavoidable. The County has adhered to the 75-foot setback from wetlands per the LCP except in one location, West Paso, where the site constraints could only accommodate a 50-foot setback and where this setback adequately and appropriately protects the adjacent wetlands.

Even so, the project includes unavoidable habitat impacts, including leach field installation at the Broderson site and pump station development throughout Los Osos. I believe that the County has appropriately limited such impacts through thoughtful siting and design, but they are impacts nonetheless. The County has calculated a total of 8.75 acres as the areal extent of these impacts due to the proposed project, 8 of which are associated with the Broderson leach field. The County also proposed significant restoration, enhancement, preservation, and long-term habitat management for the 80-acre Broderson site and for the Giacomazzi wetland buffer areas. In addition, the County has more recently proposed 'stabilization' at the Tri-W site, which, in my view, appears to be restoration in all but name. I believe that the County's proposals can form the foundation for a mitigation package appropriate to the existing circumstances, including the ongoing habitat impacts associated with the prior abandoned project and the fact that Los Osos is essentially all ESHA. I do not recommend a particular mitigation ratio because all of the project area is essentially ESHA and the concept is not as applicable in this case where there is a lack of non-ESHA land that could be converted to ESHA to offset impacts. Rather, I believe a suite of mitigation that protects and enhances existing significant ESHA areas, including atop the leach field at Broderson, where the majority of habitat impact is located, is more appropriate. The County's proposals may form the basis for a mitigation package, but they must be augmented and refined.

Accordingly, I recommend that the project require the following offsetting mitigation:

1) Restoration, enhancement, preservation, and long-term habitat management for the 80-acre Broderson site, the 12-acre Mid-Town (Tri-W) site, 8.3 acres on the Giacommazi site, and a total of nearly 1 acre at the various pump stations sites. All of these areas, totaling over 100 acres, should be subject to the type of habitat management plan provisions typically applied to such restoration, enhancement, preservation, and management projects.

2) A monitoring and adaptive management program designed to ensure that implementation of the project maximizes long term ground and surface water and related resource (including wetlands, streams, creeks, lakes, riparian corridors, marshes, etc.) health and sustainability. The project is generally designed to appropriately address such issues, but I believe strongly that such premise be verified and the project, as needed, adapted over time to ensure this is the case.

I believe that the project as proposed avoids habitat impacts where feasible, and where unavoidable can appropriately offset such impacts through the mitigation described above.

Condition 20. Groundwater Monitoring

PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the Applicant shall submit to the County of San Luis Obispo and the Executive Director for review and approval a Groundwater Level Monitoring and Management Plan that details methods for measuring and responding to changes in groundwater levels that could affect wetland hydrology and habitat values. In accordance with the monitoring and action plan proposed by the LOCSD and attached as pages 30 and 31 of Exhibit 6, the Plan shall include provisions for monitoring groundwater levels, surveys for wetland plant and animals, monitoring wetland hydrology and water quality, appropriate response procedures should impacts be identified, annual reporting, and an education program to encourage property owners to convert septic systems into areas capable of groundwater recharge.

Evidence of compliance: Attached is a Groundwater Level Monitoring and Management Plan which is consistent with and builds upon the LOCSD materials included as pages 30 and 31 of Exhibit 6 of the staff report. This includes an education program for septic system decommissioning.

NOTE: Compliance with Condition 18 was acknowledged by CCC staff on January 19, 2005

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BY: ML

Condition 20. Groundwater Monitoring

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Approved Ground-water monitoring + management plan per S.C. 20

APPROVED
ML 1/19/05
CALIFORNIA
COASTAL COMMISSION
CENTRAL COAST DISTRICT OFFICE
725 FRONT ST., STE. 300
SANTA CRUZ, CA 95060

CDP A-3-SLO-03-113
Special Condition 20
p. 1 of 22

Los Osos Wastewater Treatment Facility
Groundwater Level Monitoring and Management Plan

Per Coastal Development Permit condition 20

Introduction

Individual on-site septic systems artificially augment a naturally occurring supply of freshwater to existing wetlands located in the community of Los Osos. Ending their use as a consequence of the Wastewater Project may alter the extent and composition of existing wetlands.

Wetlands in Los Osos are located mostly along the fringe of Morro Bay and composed of freshwater, brackish and saltwater plant and animal species. The boundaries among these (ie, the composition of the wetlands) change from year to year as a result of weather and other natural factors. For example, reduced rainfall can lower freshwater inflow. Winds can increase erosion from wave action and increase aeolian deposition along the Bay edge. Other variables affecting these wetlands include changes to the Bay bathymetry due to subsidence, earthquakes, changes to sea level, and deposition of sediments from alluvial sources.

Wetlands and riparian resources in Los Osos in 2003 are shown on Figure 1. There are several freshwater springs in the Los Osos area which support wetlands. The most notable is Sweet Springs located north of the intersection of Ramona and Fourth Street.

To provide a context for considering the potential effects of septic tank use on wetlands resources in Los Osos, it is useful to compare the extent of such resources as they existed prior to the widespread use of septic tanks with current conditions in which there are as many as 5,000 such systems. Figure 2 is an aerial photograph of Los Osos taken in 1949 showing wetlands along the Bay fringe, Sweet Springs, and along Los Osos Creek. Two things are worth pointing out on the 1949 image. First, it is clear that extensive wetlands were present in Los Osos before significant urbanization and the use of septic systems. Second, although changes to the composition of the wetland species from 1949 to 2003 are difficult to assess, a comparison of the aerial extent of these resources (Figure 3) reveals that wetlands have decreased significantly due to urbanization.

Changes to the Groundwater Regime

The process of decommissioning 4,751 septic systems within the Prohibition Zone is expected to occur over two periods of six months or more as the collection lines become available for service. Assuming 250 working days per year, about 20 systems per day will be taken out of service (assuming contractor service is available). Thus, the lowering of groundwater levels will occur gradually and will be spread throughout the Prohibition Zone.

Eventually all of these septic systems will be taken out of service and their contribution to the groundwater regime will be replaced by the effluent disposal system which calls for the bulk of treated wastewater (about 800,000 gallons per day) to be re-introduced at the Broderson property and another 400,000 gallons per day distributed to disposal leach fields located on Santa Maria Avenue, Pismo Street and elsewhere (see Figure 4).

The groundwater model prepared for the project predicts that it will take about 18 months for groundwater levels to begin to rise again downslope from the Broderson disposal field in the vicinity of Morro Bay.

Figure 1 – Wetlands and Riparian Resources in Los Osos, 2003

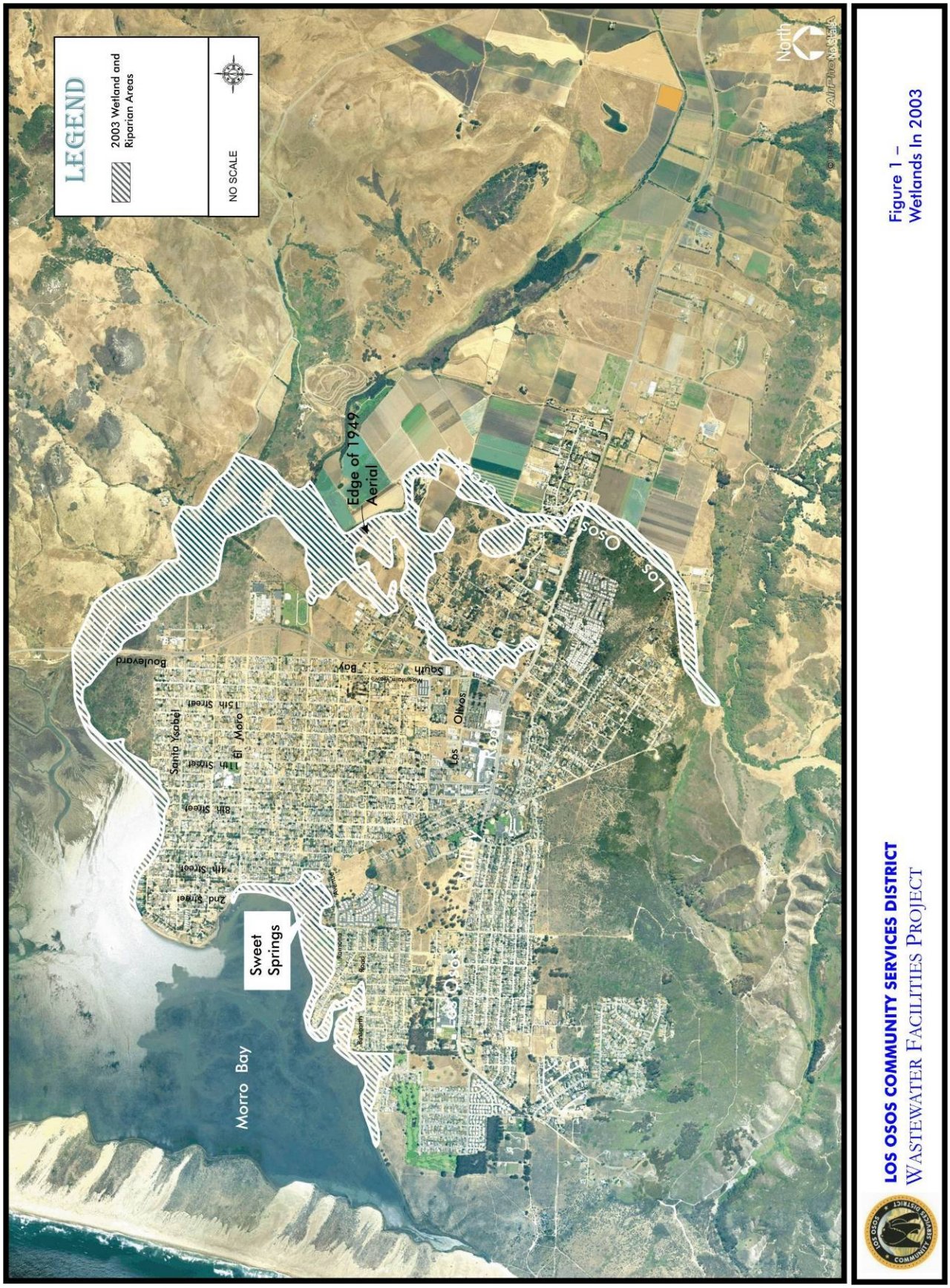


Figure 2 – Wetlands and Riparian Resources, 1949

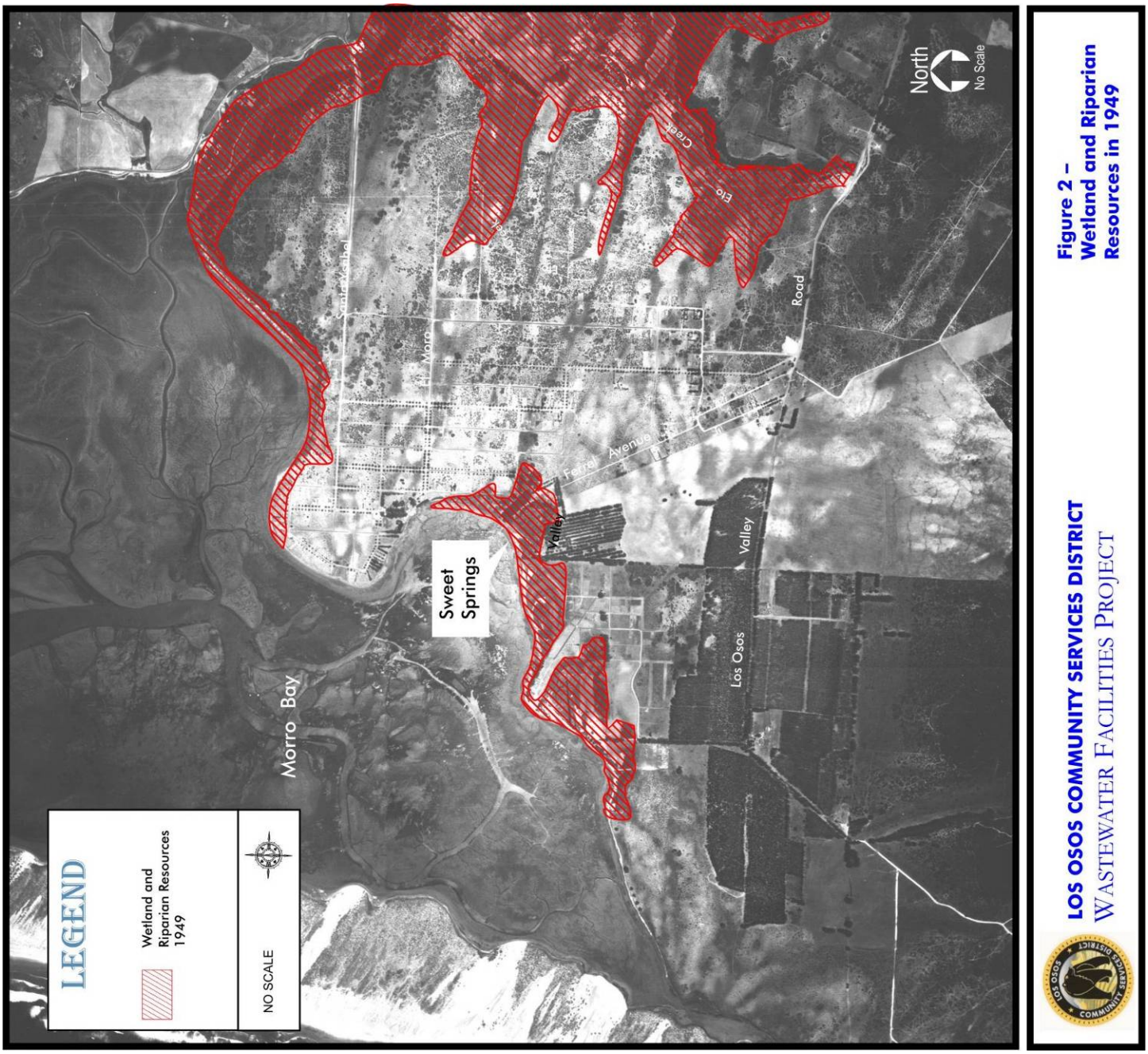


Figure 3 – Comparison of 1949 and 2003

Figure 4 – Wastewater Disposal System

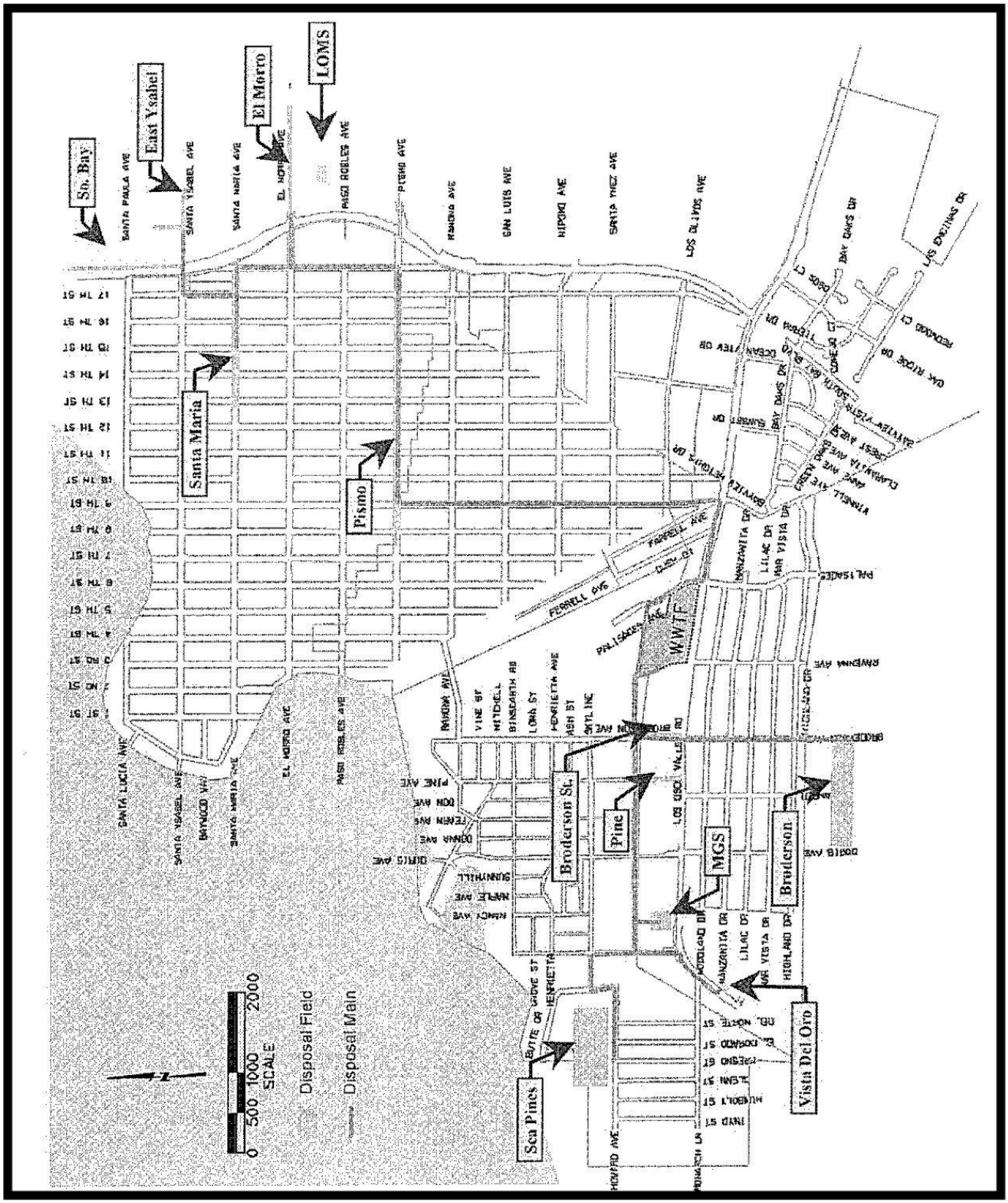


Figure 5 – Groundwater Harvest Wells and Monitoring Wells

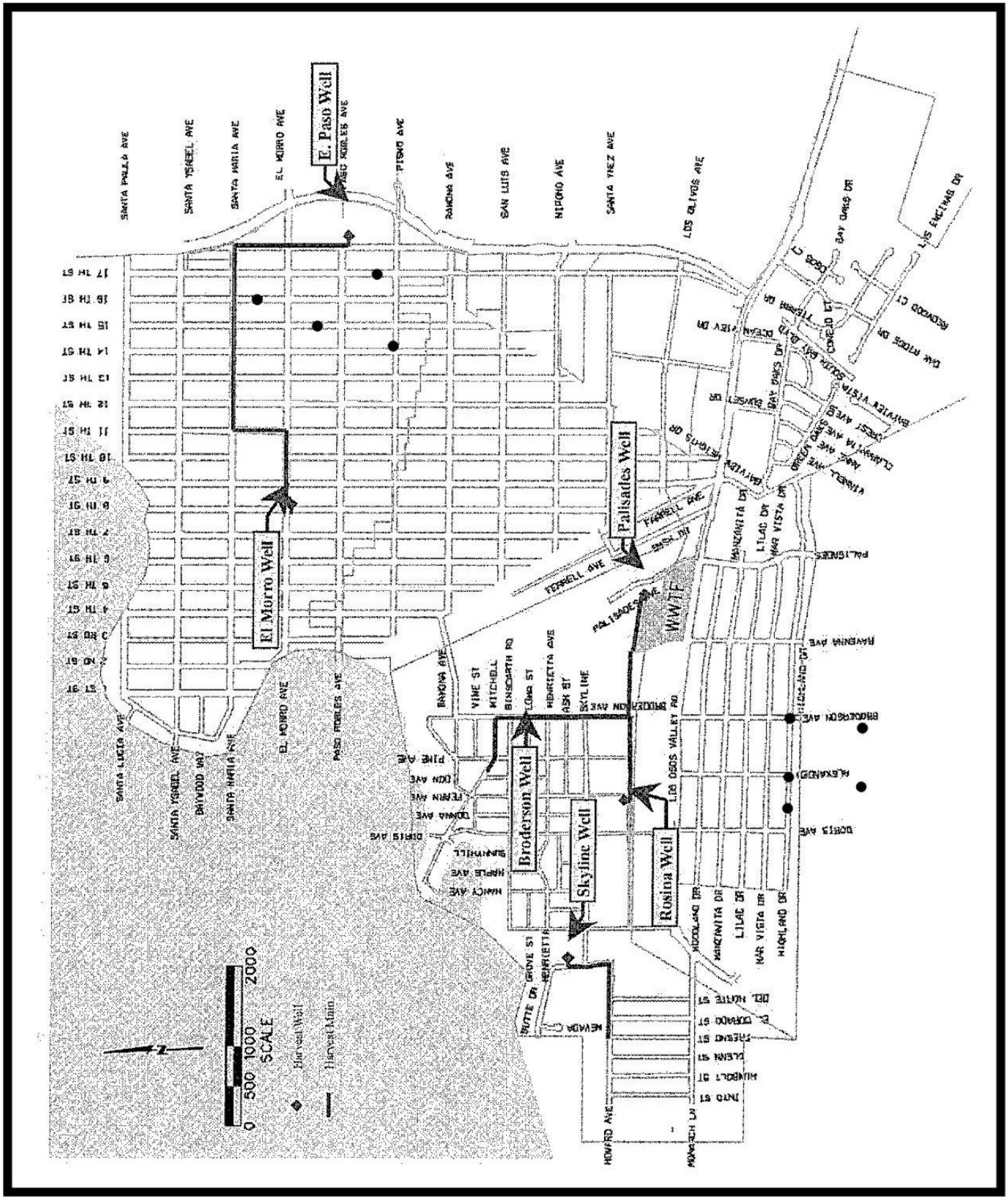


Figure 6 – Groundwater Elevations

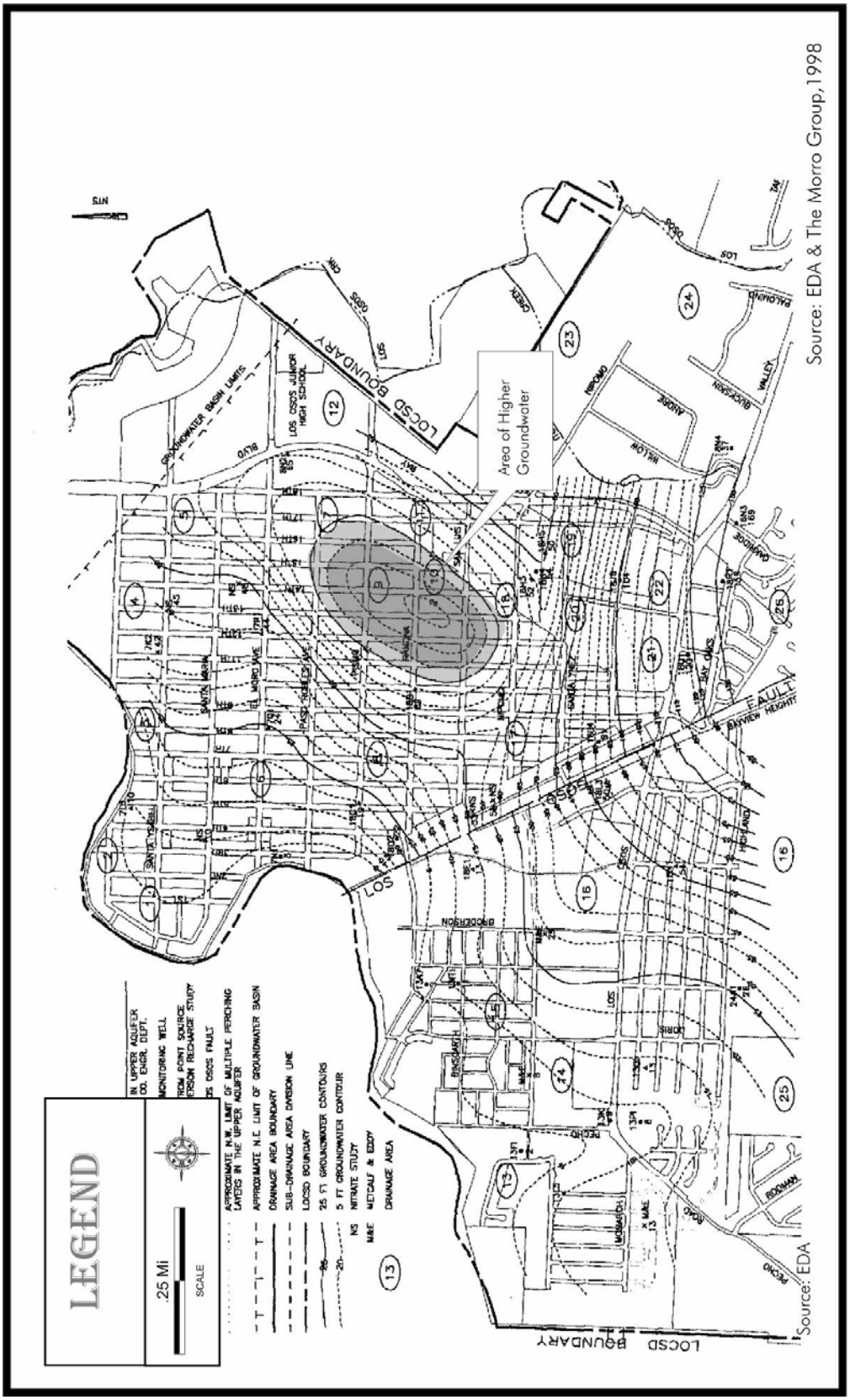


Figure 7 – Change in Groundwater Levels Over Time

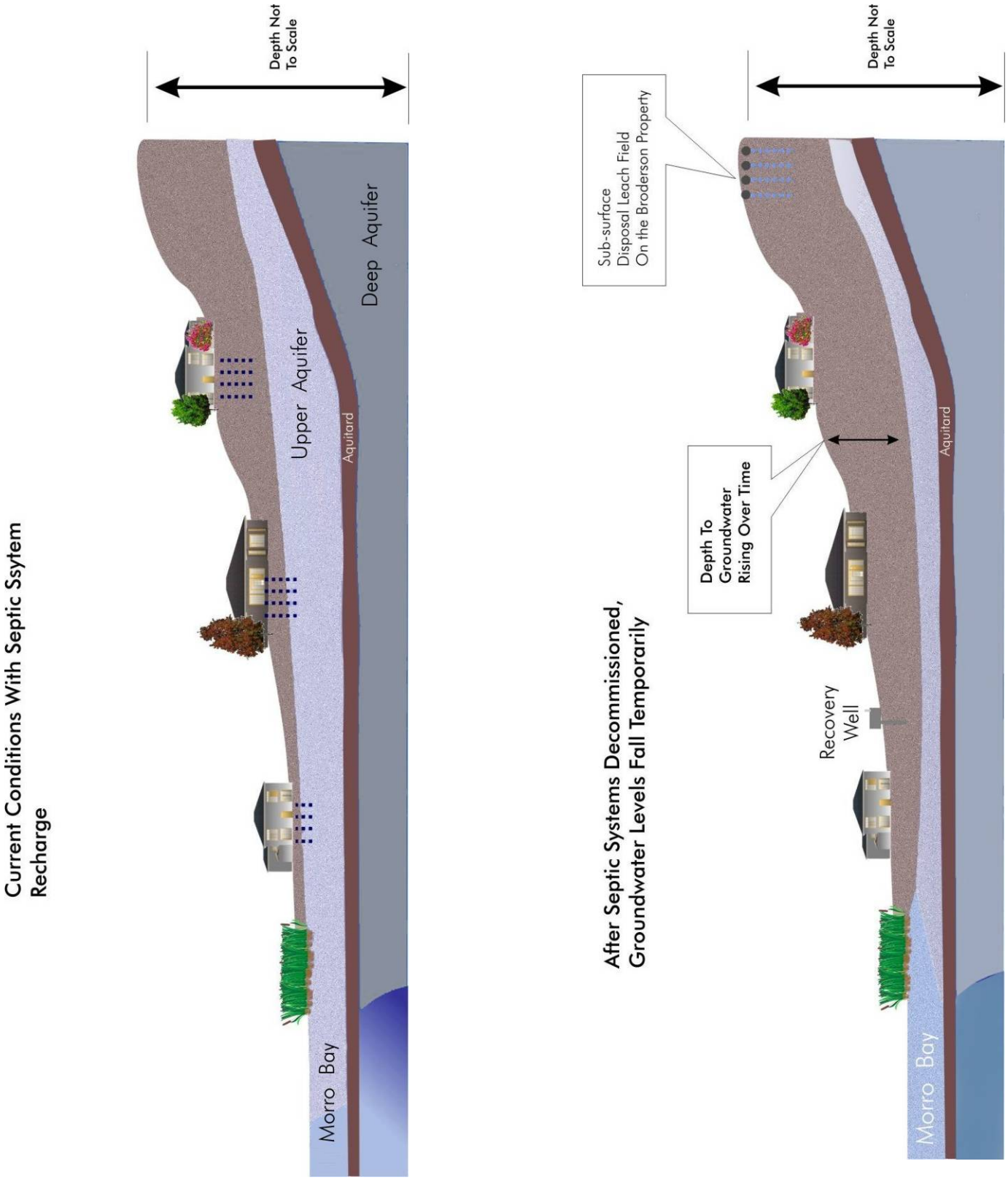
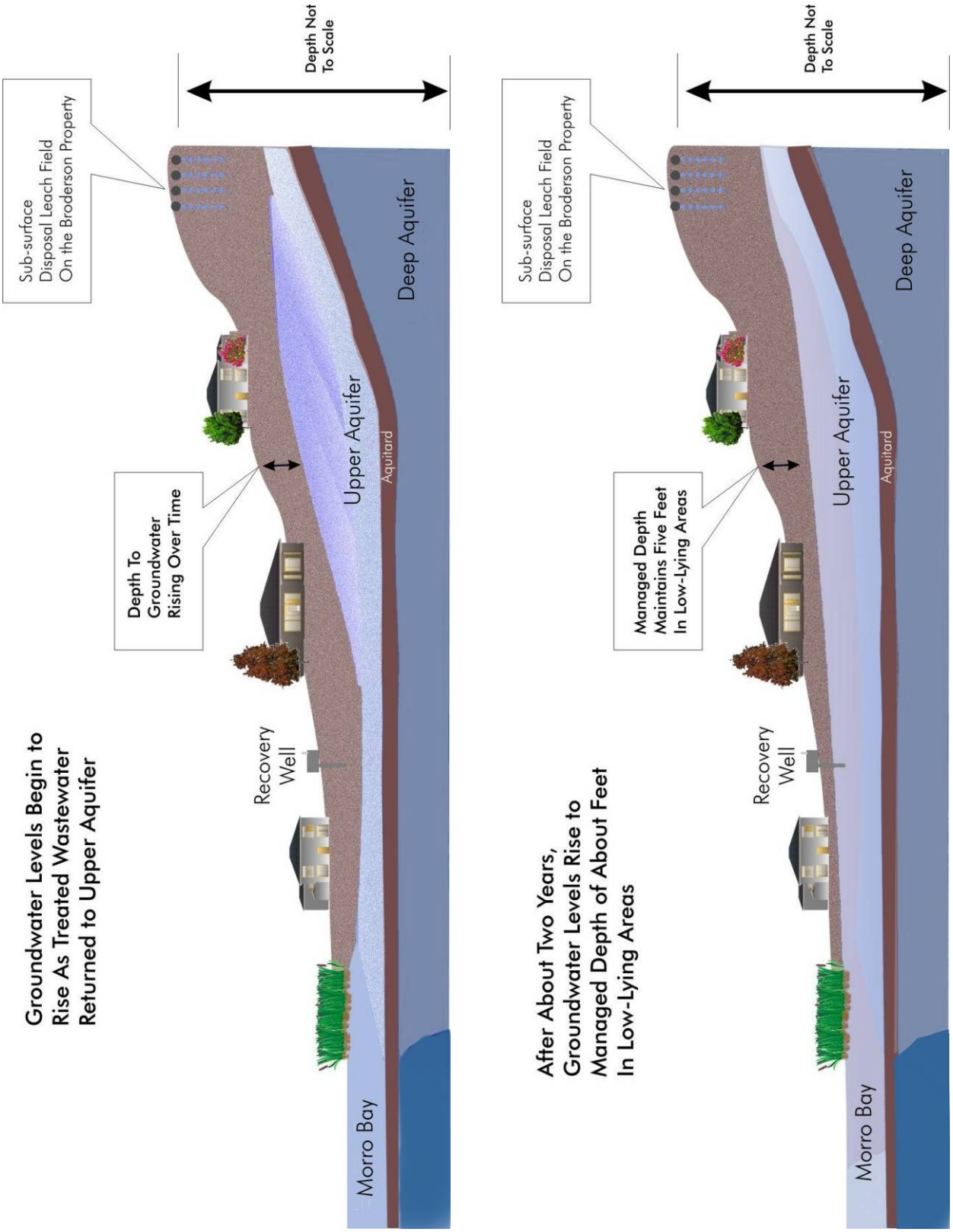


Figure 7 (cont'd)



From the onset of wastewater operations, groundwater will initially decline as septic systems go off line. Groundwater levels will be continuously monitored by a series of monitoring wells located throughout the community (see Figure 5). As treated water is returned to the aquifer at the Broderson disposal site and elsewhere, water levels begin to rise (Figure 7). A system of harvest wells will be used to prevent groundwater from surfacing in low lying areas of the community. The depths of the groundwater will be balanced by the disposal/harvest system to stabilize at about five feet below the shallowest areas of the developed portion of the community. The harvesting of groundwater will be managed to achieve three objectives:

- To ensure that groundwater re-introduced into the upper aquifer does not begin to surface downslope;

- To protect property and public health by alleviating the persistent ponding problem associated with shallow groundwater levels, especially in the vicinity of 8th Street and El Moro, and along Pismo Street and 16th Street; groundwater levels will be managed to maintain about 5 foot depth throughout low-lying areas of the community; and

- To ensure the long-term stability of wetlands resources.

Impacts to Wetlands Along the Bay Fringe (3rd Street, Sweet Springs Marsh)

Especially during the period after septic system decommissioning and before groundwater levels begin to stabilize in a state of equilibrium, the potential exists for adverse affects on the extent and composition of wetland resources in this area. The extent of the effects on these wetlands resources will be temporary (18 months to two years) after which groundwater levels will be stabilized by the groundwater management program described above.

The magnitude of this short term effect will be difficult to distinguish from those that occur naturally from factors such as:

- The seasonal variation of sunlight and rainfall;
- Changes in water quality and salinity;
- The severity of storms and resulting wave action;
- The nutrient content of the water supply;
- The extent and aggressiveness of invasive plant species.

There are several areas of fresh water springs along the Baywood-Los Osos shoreline. These areas have been studied by Dr. Don Asquith in the June 1990 “Freshwater Influences on Morro Bay” document. The areas include Sweet Springs, Pecho, Third Street and the Baywood marsh. Dr. Asquith estimated that observable flow from springs in these areas totaled 300 acre-feet per year, of which the vast majority of flow (292 acre-feet per year) occurs at Sweet Springs. This flow estimate is for a composite of natural spring flow and on-site wastewater disposal. Because of minimal development since that time, no significant human-induced changes in this flow are assumed to have occurred over the past 14 years.

One consequence of the lowering the groundwater under the community may be an increase in the influence of salt water from Morro Bay with a corresponding increase in the salt marsh or brackish composition of the wetlands along the Bay fringe. However, even with the temporary lowering of groundwater levels, vegetative areas along the Bay fringe will remain inundated as they are now. Thus, the extent of wetlands will not likely change, although the mix of fresh,

brackish and salt water species could be affected. Again, these changes, if any, are expected to be small and temporary.

Wetlands could also be affected by changes to the re-charge regime of the upper aquifer. The Wastewater Project will change the way in which water is re-introduced to the upper aquifer from the decentralized use of on-site septic systems to a more centralized system of disposal leach fields. Once groundwater levels return following septic system decommissioning, the monitoring and management program is designed to maintain stable groundwater levels at about five feet of depth in the shallowest areas of town. Another consequence of the disposal system is that recharge will actually increase on the west side of town (east of the so-called Strand B of the Los Osos fault) from the current conditions, and decrease on the east side. This could result in an increase in freshwater wetlands along the Bay fringe to the west. Overall, the net change in wetlands along the Bay fringe is expected to be slight and difficult to distinguish from natural variation.

With respect to Sweet Springs, it should be noted that this is an artesian well fed by water introduced upslope that travels underground and emerges at the spring. Sweet Springs existed long before the urbanization of Los Osos and the widespread use of septic systems. Therefore, the decommissioning of septic system is not likely to have a significant adverse effect on the Spring and surrounding vegetation.

Other Wetland Areas – Los Olivos/Mountainview Area/Eto Creek

Other wetland and riparian resources exist in the community of Los Osos near the intersection of Mountain View Avenue and Los Olivos. Septic system decommissioning is not expected to affect groundwater levels in this area to the same extent as low-lying areas along the Bay fringe because the existing septic systems on properties surrounding these wetlands will remain in operation, being outside the Prohibition Zone. Nonetheless, these areas will be subject to the same temporary lowering of groundwater levels as experienced on the west side of the Strand B 'fault'.

Los Osos Creek

At present, most of the wastewater returned to the groundwater basin from septic systems east of the so-called Strand B of the Los Osos fault flows toward Morro Bay. However, a sizeable portion flows east toward Los Osos Creek due primarily to the pronounced "mound" of groundwater that has been mapped in the vicinity of Pismo Avenue and 14th Street (see Figure 6). Generally, the higher groundwater causes areas east of 15th Street to flow toward the Creek where the freshwater helps support riparian and wetland vegetation in that area.

The disposal locations on Santa Maria Avenue and Pismo Avenue and El Moro Avenue were chosen in part to help ensure that quantity of treated wastewater reintroduced to the basin maintains balance between the east and west sides of the 'fault'. Note that these disposal sites are estimated to have a total capacity of about 320,000 gallons per day. Assuming 300 gallons per day of wastewater per single family residence, this is roughly equivalent to 1,066 dwelling units which is well in excess of the number of units east of 15th Street and south of El Moro Avenue. This suggests that these disposal lines will approximately maintain existing subsurface flows toward Los Osos Creek, (albeit through a less dispersed method than individual septic systems).

Plan Requirements and Strategy (revised January 19, 2005)

At its meeting of August 11, 2004, The California Coastal Commission included the following condition for the wastewater treatment facility in Los Osos:

> 20. PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the Applicant shall submit to the County of San Luis Obispo and the Executive Director for review and approval a Groundwater Level Monitoring and Management Plan that details methods for measuring and responding to changes in groundwater levels that could affect wetland hydrology and habitat values. In accordance with the monitoring and action plan proposed by the LOCSD and attached as pages 30 and 31 of Exhibit 6, the Plan shall include provisions for monitoring groundwater levels, surveys for wetland plant and animals, monitoring wetland hydrology and water quality, appropriate response procedures should impacts be identified, annual reporting, and an education program to encourage property owners to convert septic systems into areas capable of groundwater recharge.

To address potential affects of wetlands associated with septic system decommissioning,[1] the Los Osos CSD proposed the following Wetlands Monitoring Program prior to the Commission hearing, which would consist of at least the following components:

1. Provisions for ongoing independent monitoring of wetlands resources after completion of the wastewater project. The intent is to continue monitoring until the goal of stabilizing the extent and composition of wetlands resources has been met.

2. Repetitive surveys for plants and animals (including species of special concern) throughout the various wetland and riparian habitats. The surveys will use techniques that permit a determination of species composition and abundance. Both terrestrial and aquatic organisms should be surveyed. Timing of the surveys will be chosen to account for the variability in the abundance of plant and animal species over the seasons. To provide a baseline, surveys sufficient to characterize these resources will be completed prior to project construction.

3. Monitoring of hydrology. For tidal wetlands along the Bay, this would include a determination of the areas inundated at high and low tide, tidal prism, and water velocity. For non-tidal wetlands, this would include determination of permanent and seasonal patterns of inundation and water sources.

4. Monitoring of water quality. Repetitive sampling of various chemical and physical constituents such as salinity, pH, nutrient concentration, dissolved oxygen, temperature, and turbidity throughout the year. The sampling pattern may vary throughout the year and may include more intensive sampling over several tidal cycles to determine short-term salinity patterns.

[1] For the purposes of this report, "decommissiong" of the septic systems refers to the time when the laterals are connected from the house to the sewer, and the wastewater no longer flows into the septic system. The final disposition of the septic system (e.g. removal) will occur after the reconnection.

5. Monitoring of soil chemistry. This will serve primarily to document trends in soil salinity in tidal wetlands, but may include measurements of other constituents as required.

6. Ongoing procedures for the identification and correction of problems as they arise. Such problems may be related to the physical, chemical, or biological attributes of the resource. These procedures will include specific remedies, including (but not limited to):

    a. Artificially watering wetlands using domestic drinking water, harvest water or disposal water;
    b. Reducing the amount of groundwater harvested.

7. Provisions for timely analysis and production of annual reports. These reports will be distributed to the Department of Fish and Game, California Coastal Commission and other interested parties, including the Morro Bay National Estuary Program. The final monitoring report, submitted upon completion of the monitoring program, should analyze all monitoring data and presents different management options.

Artificially watering wetlands along the Bay fringe has at least two drawbacks. First, the water introduced at the Bay fringe would be an additional 'loss' from the groundwater basin to the Bay that would effectively lower the safe yield. Secondly, (to the extent that wetlands on the Bay fringe are currently being supplied by water from other than the upper aquifer (which may be the case for Sweet Springs and vicinity) the wastewater project could have no effect and artificial watering would not be necessary. And lastly, it should be kept in mind that it will be difficult to distinguish changes in the amount and composition of wetlands resulting from the project from those resulting from natural factors.

Although reducing the amount of harvested groundwater could maintain groundwater levels for wetlands, this practice would also lower the basin’s safe yield and may result in the periodic surfacing of groundwater/runoff which has public health and safety implications. The potential public health implications of standing water are especially problematic in light of the spread of West Nile virus.

Figure 8 Monitoring Locations

Plan Components

This plan is intended to quantify changes in wetland habitat area and habitat value potentially related to the decommissioning of septic systems throughout the community of Los Osos. The following five wetland areas have been identified as representative for monitoring due to presence or potential presence of sensitive plant and animal species (e.g., salt marsh bird's beak, California sea-blite, red-legged frog, southwestern pond turtle), and overall habitat diversity:

- The tidal wetland area located west of Pecho Road and north of the Sea Pines Golf Course;
- The Sweet Springs freshwater wetland area located north of Ramona Avenue;
- The tidal wetland area located north of and between the terminus of 6th and 7th Streets;
- The freshwater wetland area of Los Osos Creek, north of the terminus of the abandoned portion of Santa Ysabel Avenue; and,
- The freshwater wetland area of Los Osos Creek near the eastern end of Pismo Avenue and east of the Los Osos Middle School playing field.

These areas are shown in Figure 8 on the following figure. Detailed monitoring will take place at these locations prior to, during, and following septic system decommissioning (lateral connections) within the Los Osos area, in conjunction with a more general and qualitative assessment of wetland habitats throughout Los Osos. The plan will consist of three phases as described below.

Phase I. Establish Baseline Wetland and Groundwater Conditions

Baseline conditions at each monitoring site will be accurately identified and documented through the following tasks:

Literature Review

A thorough search of pertinent literature, photographs, and other available information will be made to gain an understanding of the historical size, condition, and seasonal variation of wetland habitats within the Los Osos area. In addition, literature sources documenting location of sensitive plant and animal species will be thoroughly reviewed so as to use this information in understanding potential species impacts stemming from decommissioning. Prior reports on groundwater and freshwater seeps in Los Osos will be reviewed.

Establish Initial Water Level and Conditions

Existing wastewater discharges from on-site leach fields have resulted in a rise in shallow ground water levels underlying the Baywood Park-Los Osos community. These discharges may have resulted in increased rising water along the topographically low shoreline, notably in the areas of natural springs. As on-site wastewater systems are replaced with a more regional treatment and disposal system, this plan will monitor for changing water conditions along the shoreline. The initial hydrologic study at each marsh area would involve the following:

- Soil borings and construction of two well points (piezometers), one near the water line and the other above the fresh water marsh vegetation, at each monitoring location.
- Identification from the soil borings of the shallow stratigraphy with respect to ground water flow to the marsh area, including perching clay layers and the more permeable sand layers.

- Conductivity and nitrate analyses on the water from each piezometer.
- From the piezometer data, determination of ground water level variations, as they relate to the tidal fluctuation.
- Analysis of records of historic water level variations with respect to the septic system disposal quantities in the proximity of the specific springs and marsh areas.
- Good topographic control to relate the depths to water in the piezometers with ground surface.

Perform Wetland Delineations at Each Monitoring Site

Baseline conditions relating to the size and extent of wetland habitat within each monitoring site will be established by the preparation of wetland delineations in accordance with U.S. Army Corps of Engineers (ACOE) and California Coastal Commission (CCC) methodology and wetland definitions. Jurisdictional boundaries identified during the delineation will be mapped using a Trimble Pathfinder Pro XR unit that is rated to sub-meter accuracy. A wetland delineation report for the five monitoring sites including maps, figures, photo documentation, and field data sheets will be prepared.

Establish Transect Locations and Conduct Initial Monitoring

Quantitative information regarding species diversity, habitat boundaries, and special-status species occurrences will be obtained by establishing Step-Point Transect routes through each monitoring site. The Step-Point Transect technique is a method of quickly and thoroughly determining vegetative composition and vegetative trends over an area, by walking an established route and noting individual plant species encountered at a point directly in front of the shoe at each step along the transect. A transect route will be laid-out to cross each wetland monitoring site. If sensitive plant occurrences are present, the transect route will be designed to cross the occurrence. The routes will start and end at fixed locations in upland habitat and will cross the transition zone between wetland and upland habitat at each end. Transect data will provide ground-level and foliar-level plant species percentages, and will identify changes or trends in species composition over time.

Initial transect monitoring will be performed in spring and fall prior to septic decommissioning to identify any seasonal fluctuation in species diversity and vegetative trends at each site. The initial transect monitoring results will establish the baseline vegetative composition data for comparison purposes during the course of the multi-year monitoring program. Spring and fall baseline surveys are also anticipated to provide “wet season” wetland conditions (spring surveys) and “dry season” wetland conditions (fall surveys). This will enable more accurate data comparison as the wetland monitoring program proceeds and help rule-out false negatives or impacts unrelated to the decommissioning process.

Photo Point Establishment and Baseline Photo Documentation

Photo points will be established at each monitoring site to document site conditions. Photo points will include an overview point/location, transect start and end points, and wetland/upland habitat transition points. Photo documentation will occur during spring and fall monitoring efforts.

Baseline General Wetland Assessment

A baseline qualitative assessment of general wetland conditions throughout Los Osos will be conducted before decommissioning begins. This survey will not include the five monitoring sites, and is intended to document wetland conditions in other areas of the community. An

example location would be the wetland area on the north side of Ramona Avenue near Mitchell Drive. The assessment will consist of a visual examination of accessible wetland areas and noting habitat transition areas, vegetative conditions including presence of exotic weeds or ornamental plant species, soil moisture levels, tidal influence, and other conditions. Photo points will be established, photographs of each assessment area will be taken, and assessment observations will be recorded for incorporation in the baseline conditions report.

Baseline Conditions Report

A detailed report will be prepared prior to the installations of laterals to document baseline conditions as determined by the steps outlined above. The baseline report will be submitted to the Executive Director of the Coastal Commission for his review and approval. It is understood that he may prescribe additional work if findings warrant. The baseline report will also be sent to the County of San Luis Obispo, the California Department of Fish & Game, the U. S. Fish & Wildlife Service, and the Army Corps of Engineers for their review and comment.

The District will work throughout the study with Coastal Commission staff on the data collection, analysis and recommendations for further work.

Phase II. Monitoring

Monitoring will begin approximately six months at the completion of the first phase of septic tank decommissioning in Areas A and B of the sewer service areas (which include the low-lying regions and areas close to the bay described in the facilities plan). Monitoring will include both bi-annual spring/fall transect analysis of the five representative wetland sites, an annual general overall wetland assessment, and extensive photo documentation. Phase II Monitoring is proposed to occur over a five-year period, beginning after the completion of the first phase of decommissioning. The strict parameters of the groundwater modeling will be refined after the initial investigation is complete, pursuant to the review of the Executive Director of the Coastal Commission.

Hydrologic Monitoring

The hydrologic monitoring will involve the following:

- Recording ground water levels, bay water levels and testing for ground water quality.
- The ground water level monitoring will include installing data loggers for short term detailed water level fluctuations in some of the piezometers and regular water level measurements scheduled at periodic intervals over time.
- The water level in the bay will be monitored and compared to the ground water levels. Ground water quality will be monitored with respect to the specific parameters that would impact the critical vegetation.
- The duration of the monitoring would be based on the need to observe conditions related to the health of the specific vegetation potentially impacted by the change in the wastewater disposal regimen.

Biannual Transect Monitoring

Biannual transect monitoring will occur in spring and fall, and will include photo documentation. Monitoring data will be recorded and analyzed, and results will be discussed in a brief report submitted to the Executive Director of the Coastal Commission.

Annual General Overall Wetland Assessment

An annual qualitative assessment of general wetland conditions throughout Los Osos will be conducted in July of each monitoring year. The assessment will consist of visually examining accessible wetland areas and noting habitat transition areas, vegetative conditions including presence of exotic weeds or ornamental plant species, soil moisture levels, tidal influence, and other conditions. Photos of each assessment area will be taken, and assessment observations will be recorded for incorporation in the annual report submitted to the Executive Director of the Coastal Commission.

Annual Monitoring Report

An annual monitoring report will be prepared in December of each monitoring year to document results and observed conditions and submitted to the Executive Director of the Coastal Commission. The report will compare and contrast recent data with baseline and previous annual reports, and will present conclusions based on the observed conditions and any identifiable trends. If a negative trend in wetland habitat size or diversity is identified in an annual report, recommendations to off-set wetland impacts will be made immediately, and will not be postponed until preparation of the final monitoring report.

Final Monitoring Report and Wetland Delineation

At the conclusion of the monitoring period, a second wetland delineation will be performed at the five monitoring sites to determine any changes in size and extent of wetland habitat, and a final report will be prepared to document the results of the monitoring effort. All monitoring data compiled in the baseline and annual reports will be included in the report and submitted to the Executive Director of the Coastal Commission for review and approval. The final report will quantify and discuss any changes in wetland habitat area and habitat values observed during the monitoring effort in detail, and will incorporate results of water quality/groundwater level studies conducted by the Community Services District in the area. If during the course of the monitoring it is determined that impacts to wetland areas have occurred as a result of groundwater fluctuations due to septic tank decommissioning, preparation of a mitigation plan will be required.

If wetlands impacts occur that are determined to result from the decommissioning of the septic systems, or if results of the monitoring remain inconclusive, the Executive Director of the Coastal Commission may require additional monitoring beyond the five year period anticipated by this plan.

Phase III. Mitigation Plan

The monitoring reports will identify and quantify any impacts to wetlands over the monitoring period. If wetland impacts are identified, a detailed mitigation plan will be prepared and submitted to the Executive Director of the Coastal Commission for review and approval.

The mitigation plan will identify suitable measures to restore or enhance impacted wetland areas, using a combination of methods tailored to the specific site conditions. It is anticipated that if impacts do occur, they will occur slowly and will take equal or more time to reverse. Since potential impacts will be related to a reduction of groundwater levels, such measures are likely to involve reducing harvest well quantities during dry months, artificial watering of wetland areas, redirection of road or storm drain runoff to nearby wetland areas, removing sediment deposits in wetland areas to allow more ponding to occur, and removal of non-native vegetation.

The results of the mitigation plan will be reported to the Executive Director of the Coastal Commission . All mitigation masures will be implemented in consultation with the Executive Director of the Coastal Commission, until such time that he is satisfied that the impacts have been effectively mitigated, within the requirements of the law.

Because the mitigation plan cannot be completed until the nature of the impacts are known, it is understood that the plan may require additional permitting by the County and/or the Coastal Commission.

Phase IV. Public Education Plan

The District will prepare an education package for homeowners to facilitate the conversion of septic systems into stormwater catch basins. The approach will be developed in consultation with Coastal Commission staff, Regional Water Quality Control Board and Department of Health Services personnel.

The following will be prepared by the District for use by residents within the service area:

- Information brochure detailing requirements necessary for the conversion of the septic tank and/or leach field into a stormwater catch basin. The brochure will include information on tank pumping and cleaning, gravel packing, and hook-up to the site's drainage system (including roof downspouts).
- The education program will include in its brochure a map of areas where septic system recharge is appropriate. This information will be based upon the analysis conducted under this plan and pursuant to the inter-agency consultations described above.
- District personnel trained in the conversion process to respond to inquiries from the public.
- Identification of septic haulers qualified to pump and clean tanks.
- Inspection services.

The LOCSD will do the following in order to encourage the appropriate conversion of septic systems to storm water recharge:

- Apply to the Morro Bay National Estuary Program for a grant to assist home owners with conversion, either through direct financial aid, or programmatic assistance. The MBNEP has, as some of its top priorities, the management of stormwater and the elimination of individual septic systems in Los Osos.
- Educate homeowners about the cost reductions possible with conversion versus full de-commissioning.
- Educate homeowners about the environmental benefits of infiltrating stormwater as a protection measure for Morro Bay.

The education program will be complete and in place prior to the issuance of any lateral connection permits.

Coastal Commission Meeting, January 14, 2010

4:15:35 Bruce Gibson: "We've had 30 years of groundwater pollution to the Los Osos groundwater basin and that has got to stop. We've had over 30 years of pollution to the Morro Bay National Estuary. That has got to stop and I think most commissioners sitting today are familiar with that estuary. In 2007 we took a field trip out of Morro Bay and you saw first hand the abundant and dramatic wildlife that exists both in and adjacent to that remarkable body of water. We have a project here that not only stops that pollution that I referenced but it goes several steps beyond correcting the consequences of that pollution which is the seawater intrusion that we've referenced.

4:18 Bruce Gibson "And now we respectfully ask for your concurrence on that matter (to find no substantial issue) and act to prevent an environmental disaster so we can act to protect the health of the community of Los Osos, both it's social health and it's environmental health and urge you to agree with your staff's finding of no substantial issue.

California Regional Water Quality Control Board
Central Coast Region

Linda S. Adams
Secretary for Environmental Protection

Internet Address: http://www.waterboards.ca.gov/centralcoast
895 Aerovista Place – Suite 101, San Luis Obispo, CA 93401-7906
Phone (805) 549-3147 • FAX (805) 543-0397

Arnold Schwarzenegge
Governor

January 5, 2010

California Coastal Commission
Central Coast Office
725 Front Street, Suite 300
Santa Cruz, CA 95060-4508

Dear Commissioners:

LOS OSOS WASTEWATER PROJECT - RESPONSE TO CALIFORNIA COASTAL COMMISSION STAFF'S JANUARY 14, 2010 STAFF REPORT

San Luis Obispo County is taking the necessary steps to design and construct a sustainable wastewater project in the community of Los Osos. We all understand the foundation of this project is to solve the current wastewater management problems while keeping the water in the basin. The Los Osos Wastewater Project will provide a remedy to the watershed damage caused by the current septic system discharges and produce water that will be available for reuse (i.e., landscape and agricultural irrigation).

The project, as approved and conditioned by the San Luis Obispo County Board of Supervisors, aligns with policies and goals of the State Water Resources Control Board and Central Coast Water Board. Water Board staff recognize that wastewater management in combination with groundwater basin management, conservation practices, and water reuse constitute the model for new wastewater projects within the Central Coast Region as well as the state.

Central Coast Water Board staff agrees with your staff's recommendation that the Commission determine that no substantial issues are raised by the County's approval. The proposed project meets our criteria. Central Coast Water Board staff sent a letter to the San Luis Obispo County Board of Supervisors, dated September 25, 2009, in response to County public works staff's September 23, 2009 memorandum (attached). The letter offers support for the project and provides information regarding the proposed wastewater treatment options, wastewater collection systems options, and sludge handling issues. Regardless of the wastewater treatment project the County chooses to design and construct, it must meet waste discharge requirements (WDRs[1]). These WDRs will require wastewater collection without spilling or leaking per industry

[1]The Central Coast Water Board has not yet established WDRs for the County's project. However, the Central Coast Water Board adopted WDRs for the CSD's project and we anticipate similar requirements for the County project.

standards and treatment of wastewater and biosolids that will reliably meet discharge standards, will be suitable for any reuse, and be in compliance with recycling requirements.

In summary, the project approved by the San Luis Obispo County Board of Supervisors will meet our water quality goals and comply with requirements. We encourage the Coastal Commission to accept the project and determine that the appeals raise no substantial issues.

We appreciate your work and the work of your staff on this very important project. If you have any questions, please feel free to contact me at (805) 549-3140.

Sincerely,

Roger W. Briggs
Executive Officer

Attachment: Los Osos Wastewater Project; Response to San Luis Obispo County Staff's September 23, 2009 Memorandum [September 25, 2009]

cc: Paavo Ogren, Director of Public Works

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California Regional Water Quality Control Board
Central Coast Region

Linda S. Adams
Secretary for Environmental Protection

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895 Aerovista Place – Suite 101, San Luis Obispo, CA 93401-7906
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Arnold Schwarzenegger
Governor

September 25, 2009

San Luis Obispo County Board of Supervisors
1055 Monterey Street
San Luis Obispo, CA 93408

Dear Supervisors:

LOS OSOS WASTEWATER PROJECT; APPROVAL OF DEVELOPMENT PLAN/COASTAL DEVELOPMENT PERMIT, AND RESPONSE TO SAN LUIS OBISPO COUNTY STAFF'S SEPTEMBER 23, 2009 MEMORANDUM

We all appreciate the value of healthy watersheds. In order for the Los Osos watershed to be restored to a healthy state, both its groundwater and surface waters (including the Morro Bay National Estuary) need to be protected and improved. These waters have been damaged by various water and wastewater practices and are currently far from being sustainable. Seawater is intruding the lower groundwater aquifer due to overdraft conditions in the basin. Septic systems are destroying a vital and valuable portion of the upper aquifer system. Bacteria is seeping into the estuary at high concentrations. During wet weather conditions, septic system effluent surfaces in some neighborhoods creating a hazard to public health and other natural resources of the watershed.

Central Coast Water Board staff is pleased to see San Luis Obispo County taking the necessary steps to construct a sustainable wastewater project. We continue to participate and communicate with your staff as well as the public to ensure an expeditious approval and construction process. Through the planning process, and specifically the Planning Commission review, we have witnessed the proposed wastewater project evolve into a project that encompasses cutting-edge technology and sustainability concepts. While we have not yet undertaken the thorough review that will be necessary to develop waste discharge requirements for the project, we are satisfied that the project approved by the Planning Commission will provide adequate treatment for the contemplated disposal and reuse options. We do not see a need for the Board of Supervisors to further evaluate other collection or treatment technologies during your upcoming consideration of appeals of the Planning Commission's approval.

The project, as approved and conditioned by the Planning Commission, aligns with policies and vision goals of the State Water Resources Control Board and Central

Coast Water Board. We are encouraged that the Los Osos Wastewater Project will not only provide a remedy to the damage to the watershed caused by the current septic system discharges, but will also produce water that will be available for reuse (i.e., landscape and agricultural irrigation). Over the years, as the County initially attempted to develop a project, followed by the Community Services District's attempt, a basic principle has been to solve wastewater management problems while keeping the water in the basin. We anticipate that the concept of wastewater management in combination with groundwater basin management, conservation practices, and water reuse will be a template for future wastewater projects within the central coast region as well as the state.

The County's proposed wastewater project is a vital piece of the groundwater basin management puzzle and will be a giant step toward returning the groundwater basin's sustainability. According to recent studies, recycled water will provide for a 1:1 direct reduction in the current overuse of water in the groundwater basin. While this project is expensive and a financial burden for the system users, its relative cost will diminish as the true value of water continues to evolve upward in this water-short groundwater basin, region, and state. Users cannot afford to continue non-sustainable practices in the Los Osos groundwater basin, where groundwater is the only source of water for now and the foreseeable future and where a nationally recognized estuary needs to be better protected.

As we have pointed out throughout the long history of this project, we do not specify the method of compliance or the alternatives to be used for collection, treatment, or disposal. The County must meet the waste discharge requirements or WDRs[1], which require collection without spilling or leaking per industry standards, treatment of wastewater and resulting biosolids that will reliably meet discharge standards, and for any reuse, compliance with recycling requirements. While that is the simple bottom line, we have commented on various alternatives over the years to try to ensure that the County and Community Services District (CSD) were thoroughly considering potential problems and project aspects that might require improvements or mitigation. As stated above, a basic objective for this project has been to keep the water in the basin, as it has long been recognized that this basin (similar to most Central Coastal basins) is stretching thin its available supply, and is exceeding safe yield of the groundwater basin. Over the years of project development, this problem has grown more obvious and the results are more acute today than ever. Your proposed project keeps the water in the basin.

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[1]The Water Board has not yet established WDRs for the County's project. However, the Regional Board adopted WDRs for the CSD's project and we have no reason to recommend significant changes to requirements proposed to the Water Board for the County project.

Central Coast Water Board staff presents the following responses to San Luis Obispo County staff's September 23, 2009 memorandum requesting our concurrence for selected key issues.

General Comment

First, as stated above, we do not mandate the manner of compliance. Our jurisdiction is to regulate discharges of waste and their potential to affect the quality of waters of the state, as defined by the California Water Code. Wastewater treatment projects must be designed, constructed and maintained in consideration with the design conditions (influent characteristics, effluent quality, and discharge location). In other words, wastewater treatment plants that work for one community may not work for Los Osos. For Los Osos, the Planning Commission's project adequately addresses the primary goal of the Los Osos Wastewater Treatment Project (LOWWP): elimination of pollution of the upper groundwater aquifer due to the continued use of antiquated and inadequate septic systems. Furthermore, County staff has proposed a wastewater treatment project that is consistent with state and federal requirements and policies and has undergone a rigorous public review process.

Treatment

The effectiveness of treatment systems depends on site conditions, wastewater characteristics, and day-to-day operations and maintenance. Below, Central Coast Water Board staff compares extended aeration to facultative ponds using the following five categories: nitrification and denitrification, total suspended solids removal, odor nuisance, sludge management, and other water quality and energy consumption factors.

Extended Aeration

The Central Coast Water Board regulates many wastewater facilitates that utilize extended aeration. We concur with County staff's selection of extended aeration. County staff's evaluation is consistent with industry standards[2] as well as our overall experience with the technology as used in many local communities.

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[2] U.S. Environmental Protection Agency Document No. EPA 832-F-02-008, September 2002, Wastewater Technology Fact Sheet – Aerated, Partially Mixed Lagoons. U.S. Environmental Protection Agency Document No. EPA 832-F-02-014, September 2002, Wastewater Technology Fact Sheet – Facultative Lagoons. U.S. Environmental Protection Agency Document No. EPA 832-F-02-007, September 2002, Wastewater Technology Fact Sheet –Sewers, Conventional Gravity. U.S. Environmental Protection Agency Document No. EPA 625-R-00-008, September 2001, Wastewater Technology Fact Sheet – Continuous-Flow, Suspended-Growth Aerobic Systems. U.S. Environmental Protection Agency Document No. EPA 832-F-02-006, September 2002,

Facultative Pond Systems

Facultative ponds are also used throughout the Central Coast region. We understand that County staff carefully evaluated the use of this technology for the LOWWP and found that this technology was not appropriate. The Planning Commission agreed. In our experience, wastewater treatment facilities that utilize this treatment technology have compliance problems. The Water Board has taken enforcement actions against these facilities due to noncompliance with effluent limitations. In many cases, the noncompliance was attributed to poor management of the ponds, seasonal fluctuations and turnovers, and inadequate treatment capability.

Extended Aeration Ponds / Facultative Ponds Comparison

The following table compares the two treatment technologies.

Treatment Technology Comparison

	Extended Aeration	**Facultative Ponds**
Nitrification and Denitrification	This treatment technology has a higher capacity to nitrify and denitrify without any ancillary facilities. In most cases, extended aeration may reduce the amount of nitrogen below 7 milligrams per liter. These extended aeration units are seldom affected by temperature, as they have an increased detention time which allows stabilization and increased treatment efficiency. Furthermore, these treatment facilities may be modified to include an anoxic zone, which will allow increased denitrification, thus decreasing the amount of nitrate in the effluent.	A facultative pond can moderately nitrify wastewater. However, nitrification is dependent on adequate management of the pond, aeration, mixing, consistent influent flow, consistent organic loading, and detention time. Temperature fluctuations will affect the nitrification process. Facultative ponds do not significantly denitrify and will require a separate denitrification facility to meet nitrate concentration limits .
Total	Well-operated extended	In most cases, these systems

Wastewater Technology Fact Sheet –Sewers, Pressure. Metcalf and Eddy, *Wastewater Engineering, - Treatment, Disposal, and Reuse*, Third Edition, 1991.

Suspended Solids (TSS) Removal	aeration units can achieve TSS concentrations ranging from 15 to 60 mg/L. High biomass systems achieve TSS concentrations ranging from 5 to 40 mg/L.	have an inability to adequately remove TSS and do not consistently attain 30 mg/L. Inconsistent TSS removal may lead to inefficient tertiary treatment.
Odor Nuisance	This treatment technology yields little to no odor. Odors are produced by decomposition and off-gassing from settled sludge. However, these treatment facilities typically allow for complete mixing, which keeps the solids suspended with little to no settlable solids.	If the top aeration layer is not maintained, odor issues may result. Seasonal algal growth and decay may also increase odors as well as vectors.
Sludge Management	It is important that suspended solids be in contact with the wastewater, which requires complete mixing of the channels. Solids are managed through waste activated sludge (WAS) removal. WAS percent removal is typically determined by treatment quality and aeration tank conditions. The WAS is removed, dewatered, and hauled from the site.	In general, less sludge is produced. In colder climates sludge accumulation will increase due to low microbial activity. Settled sludge may require more frequent removal.
Compliance with Effluent Limitations	Extended aeration facilities have superior treatment capability, which allows the discharge to comply with effluent limitations. Treatment efficiency of these systems is consistent and rarely affected by seasonal fluctuations. High removal of toxic organics and heavy metals.	Facultative ponds typically experience increased pH concentrations during the summer months. Seasonal pond turnover may increase TSS and turbidity in the effluent. A separate denitrification facility may be needed to meet effluent limitations.

According to the industry standards footnoted on Page 3, both systems have advantages and disadvantages. Fundamentally, effectiveness of both systems is highly dependent on adequate operations and maintenance.

Facultative ponds may have higher operational costs due to their sensitive nature and their dynamic fluctuations throughout the year. The Los Osos Valley is prone to cooler conditions through a large part of the year. The cooler conditions may render facultative ponds inefficient with respect to suspended solids removal, nitrification, and sludge accumulation. Furthermore, more land area is required for a facultative pond system than for extended aeration. We would anticipate that the County design a redundant system to allow for maintenance and emergency operations. Finally, the primary goal of the LOWWP is compliance with Resolution No. 83-13 and to alleviate groundwater contamination of nitrate due the use of septic systems. A facultative system will have to include a process for denitrification to meet waste discharge requirements. Because facultative ponds do not denitrify, the County would have to propose a separate denitrification unit, which would have additional cost, operational, land area, and energy implications.

Extended aeration systems pose a lesser operational burden when compared to facultative pond systems. Additional benefits include increased nitrification and denitrification, which would satisfy the primary goal of the project and future waste discharge requirements. Although we would expect redundancies in an extended aeration system, it would be less land intensive. According to the Planning Commission's approved LOWWP, the treatment plant site will be closer to residential populations and public use areas. Therefore, odor control will be more important. Extended aeration systems have little to no odor as compared to a facultative ponds system.

Collection

We understand that the project approved by the Planning Commission includes a hybrid gravity system. There has been considerable debate about what type of collection system is appropriate for this project, much of it centered on traditional gravity systems vs. septic tank effluent pump (or STEP) systems. The success of any system, much like a treatment system, is dependent on adequate operations and maintenance, design, sizing, and installation, among other elements. Furthermore, both systems would be subject to regulations contained in the Statewide General Waste Discharge Requirements for Sanitary Sewer Systems (General Permit No. 2006-0003-DWQ or General WDR). The General WDR requires the owner/operator of the collection system to develop a management plan, which includes routine maintenance, emergency response, and reporting. In order to compare the two systems, Central

Coast Water Board staff used three categories: maintenance and operation, solids handling, and exfiltration.

Gravity Collection Systems

Conventional gravity collection systems have been used for years throughout the country and procedures for their design are well established. The Planning Commission approved a hybrid gravity collection system, which includes traditional gravity collection lines with low-pressure grinder pumps for low-lying areas. In our experience, we have municipalities with gravity collection systems that successfully transport sewage to the wastewater treatment plant and others that remain problematic. As one might expect, those systems that are much older have more problems and require more maintenance. Some portions of systems in Central Coast Region municipalities are more than a century old, and were not built with today's standards or materials. The fact that these older portions of systems continue to function as well as they do is testament to the efficacy of the concept. Successful gravity collection system programs incorporate a combination of appropriate operations, maintenance, capital improvement, prioritization, and routine collection systems integrity assessments. All of these elements are required as part of the General WDR program for collection system management.

Septic Tank Effluent Pump (STEP) Systems

STEP systems were also considered for use in the LOWWP, but were not chosen in the approved project. STEP systems differ from conventional gravity collections systems because they break down large solids in the pump tank prior to discharge into the collection lines to the wastewater treatment plant. Our experience with STEP systems is limited as most of the collection systems within our region are traditional gravity systems. However, we understand that these systems can have higher energy demands and maintenance burdens compared to a traditional collection system. According to industry standards footnoted on Page 3, disadvantages include maintenance agreements, costs for operation and replacement parts, increased maintenance, increased energy demand, and short-term reliability.

Gravity Collection Systems and STEP System Comparisons

The following table compares the two collection system technologies.

Collections System Comparison

	Gravity Collection System	**STEP System**
Maintenance and Operations	Gravity collection systems require	Each pump tank will have mechanical components that

	moderate maintenance, which would be regulated by the General WDR for collections system management. Maintenance would require a maintenance district, but would most likely not require maintenance agreement with each of the individual residents. The County would have to develop a capital improvement project prioritization schedule for collection system segments that are found to be inadequate. These assessments will be required as part of the General WDR. Grinder pump installations do not require maintenance of a septic tank and have a much smaller footprint (important for Los Osos' typically small lots).	require frequent maintenance. In some cases, municipalities that utilize STEP systems establish maintenance districts that service these systems. Power outages could be an issue as they may increase the potential for sanitary sewer overflows if the STEP tank is not equipped with an alternative power source. Life cycle replacement costs for STEP systems include the short life cycle of the pumps.
Solids Transport	Gravity collection systems reply on slope and sound engineering to transport solids and grit. Depending on the County's collection system management plan, routine cleaning would be needed.	Solids accumulation in STEP tank is a major consideration. Sludge accumulates at the bottom of the tank and undergoes some anaerobic digestion. Solids need to be removed periodically. Solids removal through the use of the STEP tank reduces the wastewater strength thus improving the wastewater influent into the treatment plant. However, the removal of solids

		can impact the overall treatment system as many secondary treatment technologies (facultative ponds and extended aeration) would require increased aeration and an additional carbon source for efficient wastewater treatment.
Exfiltration	Gravity collection systems are sealed in accordance with industry standards. Exfiltration from new gravity collection lines is generally minimal. Ongoing maintenance and integrity assessment will be required to identify, manage, and repair leaks.	Watertight tanks could ensure minimal leakage of sewage and therefore, exfiltration may not occur. However, routine tank integrity inspections will be required to ensure minimal leakage and longevity of the STEP system.

From a water quality perspective, both systems appear to be feasible to design and implement. The main water quality issues regarding STEP systems are the lower oxygen and carbon concentrations delivered to the treatment plant. If STEP systems were used in the LOWWP, we would anticipate needing a carbon source amendment to the treatment plant, which has chemical addition and cost implications. Speaking of carbon, AB 32, California's Global Warming Solutions Act was signed by the Governor in September 2006, to ultimately reduce California's greenhouse gas emissions by 25 percent by 2020. Your project's carbon footprint analysis is important in accomplishing a project that will be consistent with AB 32, and your consideration in particular of increased emissions from a STEP system as compared to a gravity collection system is on target.

Sludge Handling

Sludge removal is a component of any wastewater treatment operation. Our waste discharge requirements will address sludge removal. More specifically, the Code of Federal Regulations, Title 40, part 503 discusses approved methods for disposal of sludge. Any sludge removed from the LOWWP will be subject to these regulations.

Expected Sludge Amount

As discussed in the treatment technology comparison, we anticipate that a facultative pond system will generate less sludge, provided that the facultative pond operates as designed. Anaerobic digestion in the lower layer of the pond must occur at a rate that will allow for consistent reduction in sludge amount. According to industry standards footnoted on Page 3, optimal facultative pond efficiency would result in the removal of sludge approximately every 20 years. However, these treatment processes are highly dependent on temperature, pH, and carbon source. As discussed previously, colder temperatures in the Los Osos Valley could hinder the treatment process and therefore reduce the amount of anaerobic digestion. This would lead to increased accumulated sludge and increased sludge removal. Facultative ponds are also susceptible to pH increases due to algal growth and low dissolved oxygen in the summer months. This phenomenon may also lead to reduced functionality of the pond's efficiency and anaerobic digestion.

On the other hand, extended aeration systems typically generate more waste sludge. Extended aeration systems utilize two types of sludge: return activated sludge (RAS) from the secondary clarifier and waste activated sludge (WAS). The system utilizes a balance of both RAS and WAS to maintain adequate treatment in the extended aeration system. The percentages of both RAS and WAS are calculated based on daily analysis of extended aeration efficiency. However, extended aeration units are consistent in their ability to treat wastewater despite external factors (e.g., temperature).

A STEP collection system will also generate sludge. Sludge pumped from tanks will either have to be treated at the wastewater treatment plant or hauled to another appropriate facility.

In summary, the project approved by the Planning Commission will satisfy water quality goals and be able to meet requirements. We encourage the County to accept the project approved by the Planning Commission.

If you have any questions, please feel free to contact me at (805) 549-3140.

Sincerely,

Roger W. Briggs
Executive Officer

cc: Paavo Ogren, Director of Public Works

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Appendix F: Geology

Appendix D

Draft EIR
County of San Luis Obispo
Los Osos Wastewater Project

State Clearinghouse No. 2007121034

Prepared for:

San Luis Obispo County Dept of Public Works
County Government Center, Room 207
San Luis Obispo, CA 93408
Mark Hutchinson, Environmental Program Manager

Prepared by:

Michael Brandman Associates
220 Commerce, Suite 200
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Michael Brandman Associates

November 14, 2008

the assessment of approximately $25,000 per single family residence in the Prohibition Zone (those developed properties that would benefit from the LOWWP for sanitation services).

The LOWWP alternatives consist of three main components: wastewater collection; wastewater treatment, which includes solids processing and disposal; and effluent disposal. The development of potential project alternatives and considerations were created using the preliminary design information developed by a number of sources for the CEQA/NEPA process covered by this EIR. For this EIR, a detailed environmental analysis considers four preliminary Proposed Projects on an equal basis. The preferred LOWWP selected could be any one of the four alternatives or a different combination of project components. Public review of this Draft EIR will coincide with a community preferences survey and the continuing design process. The Draft EIR availability will enable Los Osos community residents, the project team, and County elected officials to consider the LOWWP's potential environmental impacts and allow the County to identify the preferred alternative using environmental, economic, and community preferences information; incorporates appropriate mitigations; and move forward with the final design and permitting process.

2.2.3 - Project Objectives

The primary purpose of the LOWWP is development of infrastructure for a wastewater collection, treatment and disposal system to serve the community of Los Osos in the designated Prohibition Zone as required by the RWQCB. One benefit of the LOWWP is to alleviate groundwater contamination, primarily nitrates, due to contamination caused by the use septic systems throughout the community of Los Osos. Another important issue of the LOWWP involves water resources related to seawater intrusion that is contaminating the Los Osos groundwater basin. The LOWWP can be an important first step to help solve these water resource problems. How that goal is met with effluent discharge options can afford opportunities for the water purveyors to improve the local water resources.

The specific objectives of the Los Osos Wastewater Project are:

1. Develop a community wastewater project that will comply with RWQCB Waste Discharge Requirements. Address the issues of water quality defined by the Waste Discharge Requirements (WDR) for discharge limits issued by the RWQCB. The WDR discharge limitations are summarized below in Table 2-1.
2. Groundwater Quality. Alleviate groundwater contamination—primarily nitrates—that has occurred at least partially because of the use of septic systems throughout the community.

Table 2-1: Effluent and Recycled Water Limitations from Previous Waste Discharge Requirements (Order No. R3-2003-0007)

Effluent Limitations			
Constituent	**Units**	**Monthly Average**	**Daily Maximum**
Settleable Solids	mg/L	0.1	0.5
BOD*, 5-Day	mg/L	60	100
Suspended Solids	mg/L	60	100
Total Nitrogen (as N)	mg/L	7	10
Recycled Water Limitations			
Constituent	**Units**	**Monthly Average**	**Daily Maximum**
BOD, 5-Day	mg/L	30	30
Suspended Solids	mg/L	90	90
Turbidity	NTU	2**	5**
pH	Units	In range 6.5 to 8.4	

Notes:
BOD = Biological Oxygen Demand mg/L = milligram per liter
NTU = Normal Turbidity Units
* Biological Oxygen Demand
** 24-hour mean value
*** Turbidity must not exceed 5 NTU more than 5 percent of the time within a 24-hour period and must not exceed 10 NTU.
Source: Central Coast Regional Water Quality Control Board Order No. R3-2003-0007.

3. Other Objectives:
   a. Environmental Impacts. Incorporate measures to minimize potential environmental impacts on the Los Osos community and surrounding areas. These include, but are not limited to sustainability of environmental principles of habitat conservation, endangered species and habitat, air and water quality, greenhouse gas emissions, wetlands and estuary preservation or enhancement, agricultural lands enhanced.
   b. Project Costs. Meet the project water quality requirements while minimizing life-cycle costs and mitigating affordability impacts on the community.
   c. Regulatory Compliance. Comply with applicable local, state, and federal permits, land uses, and other requirements including the Local Coastal Plan, Environmentally Sensitive Habitat Areas (ESHA standards), State Marine Reserve, and archeological concerns.
   d. Water Resources. Address water resource issues by mitigating the Project's impacts of saltwater intrusion. Furthermore, the wastewater project will maintain the widest possible options for beneficial reuse of treated effluent.

In addition, this document will be prepared to fulfill the "CEQA Plus" requirements of the State Water Resources Control Board Division of Financial Assistance in order for the County to be eligible for other state grants, loans or other considerations.

2.3 - Project Alternatives

The facilities that are part of the four alternative proposed projects evaluated in the Draft EIR are located at several locations within and outside the Los Osos Community. Each Proposed Project includes a conveyance system, a wastewater treatment process, a treatment plant, a primary wastewater pumping station and effluent disposal sites. Some project elements, such as the Broderson leachfield and the Tonini spray fields, are common to all four Proposed Projects; other elements are included in only one alternative. Three of the potential treatment plant sites (Branin, Cemetery and Giacomazzi) are located on adjacent parcels, and there are several potential LOWWP configurations that include several of these parcels simultaneously.

Table 2-2 summarizes key points for each of the four alternative proposed projects under review including treatment plant site and process, effluent disposal options, conveyance systems and storage locations.

Table 2-2: Proposed Projects

Proposed Project	Treatment Plant Site	Collection System	Conveyance Systems		Treatment Process	Storage Location	Effluent Disposal
			Raw Wastewater	Treated Effluent			
1	Cemetery - Giacomazzi - Branin	STEP/ STEG	Mid-town Central Point to Giacomazzi	Giacomazzi to Broderson and Tonini	Facultative Ponds (Secondary Treatment)	Onsite at Cemetery - Giacomazzi - Branin	Broderson Leachfield, Tonini Spray fields and Conservation
2	Giacomazzi	Gravity	Mid-town Pump Station to Giacomazzi	Giacomazzi to Broderson and Tonini	Oxidation Ditch or Biolac (Secondary Treatment)	At Tonini Spray field Site	Broderson Leachfield, Tonini Spray fields and Conservation
3	Giacomazzi - Branin	Gravity	Mid-town Pump Station to Giacomazzi	Giacomazzi to Broderson and Tonini	Oxidation Ditch or Biolac (Secondary Treatment)	Onsite at Giacomazzi	Broderson Leachfield, Tonini Spray fields and Conservation
4	Tonini	Gravity	Mid-town Pump Station to Tonini	Tonini to Broderson and onsite at Tonini	Facultative Ponds (Secondary Treatment)	Onsite at Tonini treatment and spray field site	Broderson Leachfield, Tonini Spray fields and Conservation
Source: Appendix B-8: Kennedy/Jenks Consultants, 2008, Los Osos Wastewater Project Environmental Impact Report Draft Proposed Projects Descriptions, Draft August 1.							

The four projects identified in the table above and discussed below represent a discrete combination of treatment plant sites, collection system types, wastewater conveyance system schemes, and effluent storage and disposal techniques. They form the basis for analysis in this Draft EIR. However, it is possible that any combination of these elements may be used for the County's preferred alternative identified through this Draft EIR process and for the County to make findings that support the final project decision.

Cumulative

Proposed Projects 1 through 4

Less than significant.

Seismic-Related Ground Failure

5.4-C:	**The project may expose people or structures to potential substantial adverse effects, including the risk of loss, injury or death involving seismic-related ground failure, including liquefaction.**

Project-Specific Analysis

Proposed Project 1

Collection System

Liquefaction can result in ground mobility that impacts pipeline grades, or results in pipelines floating out of the ground in areas of liquefaction. The collection system under Proposed Project 1 would consist of approximately 45 miles of pipeline that will essentially be constructed through the Los Osos Community. Loose sand blankets are found at the upper five to ten feet of the ground surface over most of the collection system area. Portions of the collection system network traverse areas having a relatively high potential for liquefaction. The potential for liquefaction and seismic settlement to impact pipelines may be governed by the depth of the pipeline relative to the depth of liquefiable soils. The proposed collection system for Proposed Project 1 may experience significant liquefaction impacts. Furthermore, this potential significant impact could result in pipeline breaks and release of untreated and/or treated effluent along the proposed collection/conveyance system, including within Los Osos Creek and Warden Creek.

Treatment Plant Site

Based on an investigation of the treatment plant site that encompasses Cemetery, Giacomazzi and Branin properties, materials of undifferentiated Paso Robles Formation and/or alluvium were encountered in each of the explorations. The upper 3 to 4 feet of materials appeared to be relatively loose/soft and likely represent topsoil/colluvial materials disturbed during previous agricultural/plowing activities. There appears to be a low potential for liquefaction to impact these sites based on currently available information. Although the potential is low, the proposed facilities at the treatment plant site may experience significant liquefaction impacts.

Disposal Sites

The spray field irrigation at Tonini would have little impact on the potential for liquefaction. Should liquefaction occur at the site, it is unlikely that the occurrence of liquefaction would impact the suitability of the site for spray irrigation.

The proposed effluent system at Broderson would be located on a relatively gently sloping hillside approximately 1,200 feet south of Highland Avenue. Based on previous investigations, the depth to groundwater is greater than 100 feet below the existing ground surface, and except for the near-surface loose dune sand deposits, the deeper soils encountered beneath the site is generally dense and not susceptible to liquefaction or seismic settlement. The near-surface loose dune sand would not be

considered potentially liquefiable. The proposed disposal at the Broderson site would include up to 448-ac ft per year of treated wastewater effluent. Based on the *Viable Project Alternatives Fine Screening Analysis* prepared by Corollo Engineers in August 2007, the capacity of Broderson site without the need to use harvest wells is a maximum flow of 896-acre feet per year. This annual volume would not result in rising groundwater levels to the surface of the Broderson site. The proposed project includes the use of Broderson at half of its capacity, which further support that the groundwater would not rise to liquefy the near surface loose dune sand. Thus even in the event the near surface loose dune sand were saturated due to precipitation or effluent disposal at the time of an earthquake, the groundwater depths would not rise near the ground surface at the site. Therefore, the proposed facilities at Broderson would not change the potential for liquefaction or seismic settlement to occur within the soils because of the effluent disposal system and estimated mounding at the Broderson site.

The Cleath 2000 study refers to disposal moving laterally off site under homes saturating Horizon A. The ground water is perched. This Fugro analysis ignores this finding from the earlier study.

Combined Effects

As discussed above, there are facilities that are part of Proposed Project 1 that may experience significant liquefaction impacts. Therefore, the combined liquefaction impacts are considered significant.

Proposed Project 2

Collection System

The potential for liquefaction to impact the proposed collection system facilities for Proposed Project 2 would be the same as described above for Proposed Project 1.

Treatment Plant Site

The potential for liquefaction to impact the proposed facilities at the treatment plant site for Proposed Project 2 would be the same as described above for Proposed Project 1.

Disposal System

The determination of no potential for liquefaction to impact the proposed disposal facilities for Proposed Project 2 would be the same as described above for Proposed Project 1.

Combined Effects

As discussed above, there are facilities that are part of Proposed Project 2 that may experience significant liquefaction impacts. Therefore, the combined liquefaction impacts are considered significant.

Proposed Project 3

Collection System

The potential for liquefaction to impact the proposed collection system facilities for Proposed Project 3 would be the same as described above for Proposed Project 1.

Cumulative Impact Analysis

Proposed Projects 1 through 4

The proposed facilities that are part of the collection system and at the treatment plant site for Proposed Projects 1 through 4 may expose structures to liquefaction impacts. Therefore, implementation of Proposed Projects 1through 4 may contribute to cumulative liquefaction impacts within the vicinity of Los Osos. This contribution is considered cumulatively considerable and, therefore, significant for Proposed Projects 1 through 4.

Mitigation Measures

Project-Specific

In addition to the implementation of Mitigation Measure 5.7-B.1 to reduce impacts from accidental spills due to seismic conditions, the following mitigation measures shall be implemented.

Proposed Projects 1 through 4

5.4-C1 Prior to approval of the improvement plans for the proposed facilities that are part of the collection system and at the treatment plant site, a geotechnical report that addresses liquefaction hazards shall be prepared and approved by the County of San Luis Obispo. The geotechnical report shall state the recommended actions for the collection system and treatment plant site so that potential impacts from seismically-induced liquefaction would be reduced to less than significant.

5.4-C2 Prior to approval of improvement plans, an Emergency Response Plan (ERP) shall be prepared as part of the operation and maintenance plan for the proposed collection system. The ERP shall recognize the potential for liquefaction, seismic hazards and ground lurching, to impact the pipeline or other proposed facilities, and specific high hazard areas shall be inspected for damage following an earthquake. “Soft Fixes” shall be incorporated in the ERP. Soft fixes typically consist of having a plan in-place to address the hazards, such as can be achieved by storing supplies and equipment for repair.

Cumulative

Proposed Projects 1 through 4

Implementation of Mitigation Measures 5.7-B.1, 5.4-C1 and 5.4-C2 are required.

Level of Significance After Mitigation

Project-Specific

Proposed Projects 1 through 4

Less than significant.

Cumulative

Proposed Projects 1 through 4

Less than significant.

C. In 1995, a study issued in by the RWQCB titled "Assessment of Nitrate Contamination in Ground Water Basins of the Central Coast Region Preliminary Working Draft," illustrated significant increases in nitrate concentrations over time in both the lower and upper aquifers. According to a letter from the RWQCB on July 10, 1998, 107 monitoring wells with more than 1,100 data points were used in the construction of the contour maps included in the study. The RWQCB letter stated:

Monitoring data indicates much of the shallow groundwater in the most densely developed areas exceeds 45mg/l, the drinking water standard for nitrate. For this reason, many of the shallow water supply wells have been removed from service and demand shifted to the deeper aquifer. Dependence upon the deeper aquifer exacerbates the surface water problems because the community's water supply, formerly from the upper aquifer, is now drawn from the deeper aquifer and recharged (after use) to the upper aquifer causing ground water levels to rise and flood more septic systems. Increasing surface water impacts including: restriction of portions of shellfish harvesting areas because of rising bacteria levels: water surround the Los Osos area periodically do not meet bacteria standards for water contact recreation (such as swimming, wading, kayaking and small boat sailing): and the public is increasingly exposed to surface wastewater.

These issues can be addressed with water use-efficiency septic system, and storm-water mngmt. plans

This is not supported by water quality data since 2003 (see Attachment 23)

This study and letter prompted further action to address the issue of groundwater contamination.

1.2.4 - Los Osos Community Services District

In 1998, the community voted to establish a community services district with wastewater authority. The Los Osos Community Services District (LOCSD) developed a wastewater collection and treatment project with the treatment facilities located in the west-central portion of the community (referred to as the Tri-W site but referred to as the Mid-town site in this document). The LOCSD prepared an EIR for the project and certified the EIR on March 1, 2001. After receipt of a Coastal Development Permit (CDP) project construction started in 2005. In the fall of 2005, voters recalled a majority of the LOCSD board members in a special election and the new board immediately halted construction on the wastewater project. In August 2006, the LOCSD rescinded certification of the 2001 EIR Findings and filed for federal bankruptcy protection due to default on State grants and loans.

1.2.5 - Legislative Initiatives

After the recall and suspension of construction, California Assemblyman Sam Blakely attempted to resolve the dispute between the RWQCB and LOCSD. The efforts were to no avail. Assemblyman Blakely then proposed legislation. Assembly Bill (AB) 2701 was proposed to authorize transfer of wastewater authority from the LOCSD to the County of San Luis Obispo to proceed with implementation of a project to build a wastewater collection and treatment system for the Los Osos

final proposed project's potential environmental impacts and public comments before completing and certifying the Final EIR.

The septic system prohibition drives the project; environmental goals + objectives are secondary.

3.1.2 - Project Goals and Objectives

The primary goal of the LOWWP is to construct and operate a community wastewater collection, treatment and disposal system and, thereby, comply with the RWQCB's WDR Resolution 83-13. Eliminating discharges from onsite wastewater, as directed by the RWQCB, will also help accomplish the LOWWP's second primary goal: alleviating groundwater contamination, primarily nitrates, that has occurred at least partially because of the use of septic systems throughout the community.

One of the wastewater project's secondary objectives involves water resources issues. Water resources issues are important because of seawater intrusion that is contaminating the Los Osos groundwater basin. On March 27, 2007, the County Board of Supervisors certified a "evel of Severity (LOS) III for the community of Los Osos while adopting a Resource Capacity Study of the Los Osos groundwater basin. The LOS III determination is the highest determination of a resource problem under the County's Resource Management System. The wastewater project can be an important first step to solving water resource problems. While the primary purpose of the Los Osos Wastewater Project is to construct a community wastewater system and, thereby, to alleviate groundwater contamination, how that goal is met can create or hinder opportunities for the water purveyors to improve the local water resources.

Environmental objective is vague

83-13 limits alternatives for achieving these that have fewer impacts

To summarize, the specific objectives of the Los Osos Wastewater Project are:

- **RWQCB Waste Discharge Requirements.** Address the issues of water quality defined by the Waste Discharge Requirements (WDR) for discharge limits issued by the RWQCB.
- **Groundwater Quality.** Alleviate groundwater contamination—primarily nitrates—that has occurred at least partially because of the use of septic systems throughout the community.
- **Secondary Objectives**
  - a) **Water Resources.** Address water resource issues by mitigating the project's impacts on water supply and saltwater intrusion. Further, the wastewater project will maintain the widest possible options for beneficial reuse of treated effluent.
  - b) **Environmental Impacts.** Incorporate measures to minimize potential environmental impacts on the Los Osos community and surrounding areas, (including, but not limited to, habitat conservation, endangered species and habitat, air and water quality, greenhouse gas emissions, social and economic sustainability, wetlands and estuary preservation or enhancement, cultural resources protection, and agricultural land enhancements).
  - c) **Project Costs.** Meet the project water quality requirements while minimizing life-cycle costs and the related affordability impacts to residents.
  - d) **Regulatory Compliance.** Comply with applicable local, State, and federal permits, land uses, and other requirements including the Local Coastal Plan, Environmentall

Improvements to the estuary and ESHA are not listed.

These mitigation objectives are vague and the project doesn't achieve them.

Expanded Groundwater Resources Analysis
Prepared for the
Draft EIR
County of San Luis Obispo
Los Osos Wastewater Project

Prepared for:

Michael Brandman Associates
220 Commerce, Suite 200
Irvine, CA 92602
714.508.4100

Michael Brandman Associates

November 14, 2008

02240002

HOPKINS
GROUNDWATER
CONSULTANTS, INC.
THE WATER RESOURCE SPECIALISTS

October 31, 2008
Project No. 07-016-01

Michael Brandman Associates
220 Commerce, Suite 200
Irvine, California 92602

Attention: Mr. Michael E. Houlihan
Manager of Environmental Services

Subject: Final Report of Preliminary Hydrogeological Impacts Study, Los Osos Wastewater Project, Los Osos, California, Prepared for: County of San Luis Obispo, October, 2008.

Dear Houlihan:

Hopkins Groundwater Consultants, Inc. (Hopkins) is pleased to provide this final report summarizing the findings, conclusions, and recommendations of the subject preliminary hydrogeological study which analyzed the potential impacts of the proposed Los Osos Wastewater Project.

We trust the information contained in this report sufficiently describes present groundwater basin conditions and the anticipated changes that will result from the project. If you have any questions or need any additional information, please give us a call.

REGISTERED GEOLOGIST
CURTIS J. HOPKINS
EG NO. 1800
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

Sincerely,

HOPKINS GROUNDWATER CONSULTANTS, INC.

Curtis J. Hopkins
Principal Hydrogeologist
Certified Engineering Geologist EG 1800
Certified Hydrogeologist HG 114

Brian M. Cosner
Staff Hydrogeologist

c:

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P.O. Box 3596, Ventura, California 93006 Phone: (805) 653-5306 e-mail: chop4@earthlink.net

Table 11 - Effluent Water Limitations from Previous Discharge Requirements (Order No. R3-2003-0007)

EFFLUENT LIMITATIONS			
CONSTITUENT	UNITS	MONTHLY AVERAGE	DAILY MAXIMUM
SETTLEABLE SOLIDS	MG/L	0.1	0.5
BOD*, 5-DAY	MG/L	60	100
SUSPENDED SOLIDS	MG/L	60	100
TOTAL NITROGEN (AS N)	MG/L	7	10

*Biological Oxygen Demand

The treatment facilities are being designed to produce an effluent that will have an average NO_3-N concentration of 7 mg/l and an estimated TDS concentration of 620 mg/l (Carollo, 2007b). The average nitrate concentration presently in the Los Osos Basin in the proximity of the prohibition zone groundwater is on the order of 10 mg/l (NO_3-N) (Y&W, 2003) and the average TDS concentration is approximately 330 mg/l (C&A, 2005c).

Effluent disposed at Broderson would have a positive affect on slowing the current conditions of seawater intrusion in the lower aquifer zones and flushing nitrate laden water from upper aquifer zones. The slow turnover rate of groundwater has been identified as the single most important basin characteristic affecting water-quality trends in the Los Osos Basin (Y&W, 2003). This occurs because the volume of groundwater in storage is relatively large compared to annual inflows and outflows. The result is that any action to decrease nitrogen loading (i.e., the LOWWP) will take a relatively long time to have an effect. As a result, nitrate concentrations in some deep wells may continue to increase for many years before the effect of septage removal reaches the lower aquifer system. Recent study has concluded that the shallow aquifer system may take on the order of three decades to equilibrate to a change in nitrate loading (Y&W, 2003). Regardless of the time frame required to realize a reduction in nitrate concentrations across the Los Osos Basin this impact is considered a beneficial impact to the basin.

To assess the impacts of TDS and NO3-N concentrations in the Los Osos Basin caused by effluent disposal at Broderson, a mass balance calculation was performed using septic return flows, precipitation, irrigation, subsurface cross flows and effluent disposed at Broderson at a rate of 448 AFY. The hydrologic budget

present Willow Creek conditions are shown in Appendix A (see Plate A2). The creek flows a small amount during most of the year that primarily supports dense riparian vegetation. Flows in Willow Creek are fed by rising groundwater but they do not reach the bay except when Los Osos Creek is flowing to the bay. * Willow Creek supplies Los Osos Creek and the estuary.

An unnamed drainage channel in the vicinity of the mobile home park, south of Los Osos Valley Road, reportedly flows seasonally through the oak preserve into Los Osos Creek in the vicinity of Los Osos Valley Road (TMG & TES, 1990).

Table 2 – Summary of Local Surface Water Features

SURFACE WATER FEATURE	SEASONALITY	SIZE OR RATE OF FLOW	SOURCE
LOS OSOS CREEK (AT LOS OSOS ROAD BRIDGE)	EPHEMERAL	1,630 TO 4,110 AFY	MORRO GROUP, 1990
WILLOW CREEK (ETO CREEK)	EPHEMERAL	438 AFY (DISCHARGE FROM PERCHED AQUIFER)	YATES & WILLIAMS, 2003
ETO LAKE	PERENNIAL	NA	NA
SWEET SPRING	PERENNIAL	292 AFY	MORRO GROUP, 1990
SWEET SPRING MARSH	EPHEMERAL	NA	MORRO GROUP, 1990
PECHO ROAD MARSH	EPHEMERAL	NA	MORRO GROUP, 1990
THIRD STREET MARSH	NA	APPROX. 2-5 GPM OBSERVED	MORRO GROUP, 1990
BAYWOOD POINT SPRING	NA	APPROX. 5 GPM	MORRO GROUP, 1990
BAYWOOD MARSH	NA	NA	MORRO GROUP, 1990
LOS OSOS CREEK ESTUARY	NA	SEVERAL SMALL OUTFLOW CHANNELS AT APPROX. 0.5 GPM	MORRO GROUP, 1990

Flows will be reduced to near zero with the project (see Page 4 of this attachment).

From the LOWWP Draft EIR, Appendix D-2
(Available at http://www.slocounty.ca.gov/PW/LOWWP)

Table 3 – Average Groundwater and LOWWP Effluent TDS Concentrations

WATER SOURCE	TDS (MG/L)
PERCHED AQUIFER	400[1]
CREEK COMPARTMENT	520[2]
UPPER AQUIFER SYSTEM	330[3]
EFFLUENT	620[4]

[1] - MASS BALANCE CALCULATION BASED ON PRECIPITATION, IRRIGATION AND SEPTIC RETURN FLOWS
[2] - C&A, 2005c, PART 2, PAGE 55, PAR. 2
[3] - C&A, 2005a, TABLE 5 - AVERAGE CONCENTRATION FOR MONTH OF APRIL, 2005
[4] - FINE SCREENING REPORT, SECTION 2.3.1.1

Nitrate

Sample results from previous basin study show that NO_3-N concentrations measured in dedicated monitoring wells range from less than 1 mg/l to 28 mg/l with an overall average of 10 mg/l (NO_3-N) (C&A, 2005a). The concentrations of NO_3-N contained in groundwater in the basin and the proposed effluent to be used for disposal within the basin are listed in Table 4 – Average Groundwater and LOWWP Effluent Nitrate Concentrations.

Table 4 – Average Groundwater and LOWWP Effluent Nitrate Concentrations

WATER SOURCE	NO_3-N (MG/L)
PERCHED AQUIFER	NA
CREEK COMPARTMENT	5 TO 10[1]
UPPER AQUIFER SYSTEM	10[2]
EFFLUENT	7[3]

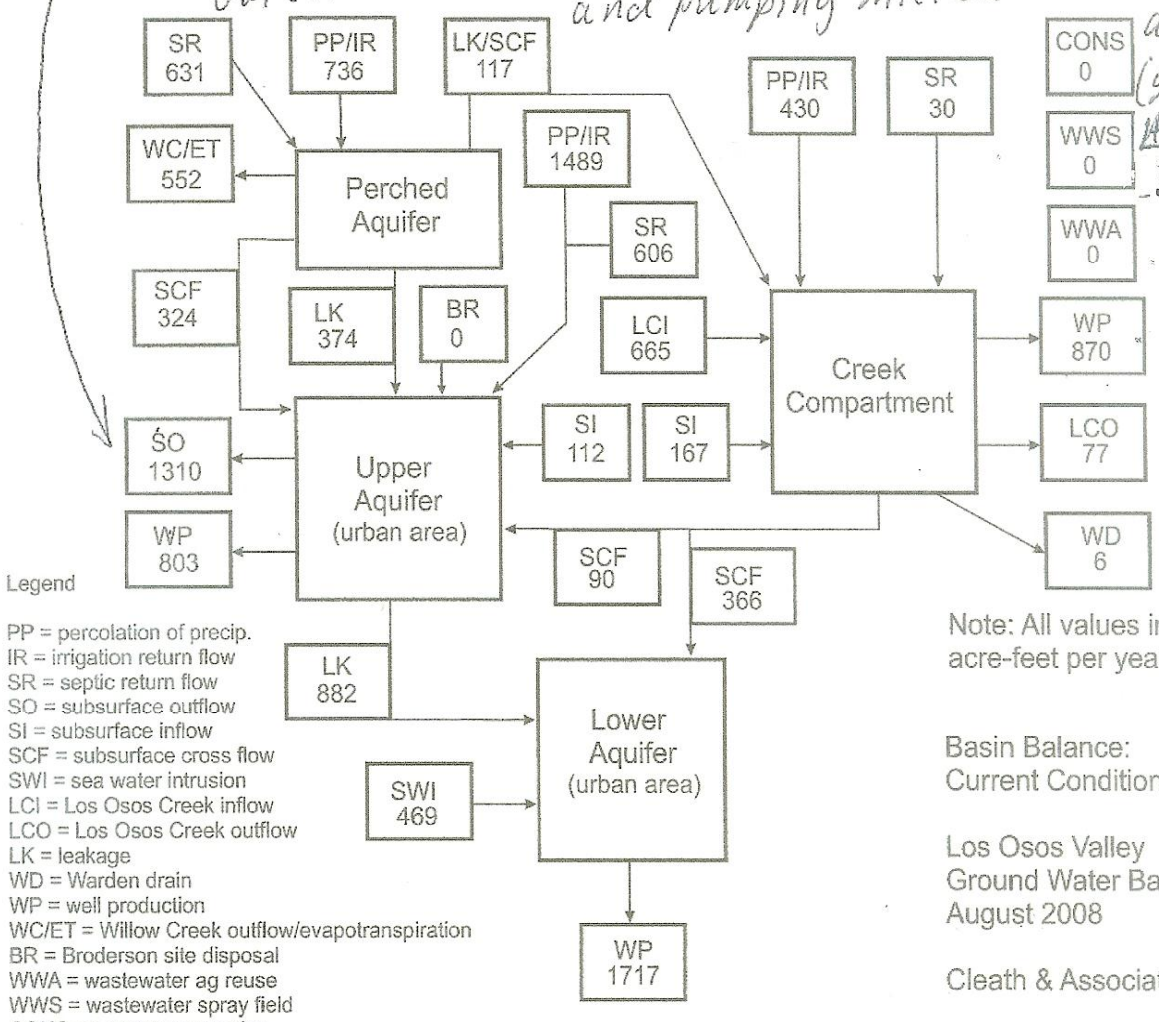
[1] – YEATS AND WILLIAMS, 2003
[2] - C&A 2005a, TABLE 5,
[3] - FINE SCREENING REPORT, SECTION 2.3.1.1

Average nitrate levels are at drinking water standards.

There is an isolated area of low NO_3-N concentrations that is inferred to extend across the open space west of the South Bay Community Library where considerable

From Appendix C of
DEIR Appendix D-2

Current outflows to the ocean from the upper aquifer. This is needed to prevent sea water intrusion in the upper aquifer. Outflows are reduced by 400 AFY w/ the project and pumping shifted to the upper aquifer (see Attachmnt 32 pp3, 4)



DEIR Appendix D-2

These outflows are needed to prevent sea water intrusion in the upper aquifer (see p. 14 of Appendix D-2; also Attachment 4)

Table 8 – Current Basin Balance Conditions

COMPONENT OF WATER BUDGET	PERCHED AQUIFER	CREEK VALLEY AQUIFER	UPPER AQUIFER	LOWER AQUIFER
PERCOLATION FROM PRECIPITATION AND IRRIGATION	736	430	1,489	0
SEPTIC RETURN FLOW	631	30	606	0
SUBSURFACE OUTFLOW	0	0	- 1,310	0
SUBSURFACE INFLOW	0	167	112	0
LEAKAGE OR SUBSURFACE CROSS FLOW IN	0	117	788	1,248
LEAKAGE OR SUBSURFACE CROSS FLOW OUT	- 815	- 456	- 882	0
SEAWATER INTRUSION	0	0	0	469
LOS OSOS CREEK INFLOW	0	665	0	0
LOS OSOS CREEK OUTFLOW	0	- 77	0	0
WELL PRODUCTION	0	- 870	-803	-1,717
WARDEN DRAIN	0	- 6	0	0
WILLOW CREEK OUTFLOW AND EVAPOTRANSPIRATION	- 552	0	0	0
AQUIFER INFLOW	**1,367**	**1,409**	**2,995**	**1,717**
AQUIFER OUTFLOW	**- 1,367**	**- 1,409**	**- 2,995**	**- 1,717**

ALL TABLE QUANTITIES ARE IN ACRE-FEET PER YEAR

The flows are currently supporting Willow Creek, raparian habitat.

A comparison of the septic return flow volumes in Tables 8 and 9 shows the reduction in this component in the hydrologic budget that is effectuated by the LOWWP. Roughly half of the recharge from septic system percolation is located over the perching clay layer while the remainder is located over the upper aquifer in areas not confined by the clay layer. As indicated by the reduction in this recharge component (see Table 9) the LOWWP effectively captures over 90 percent of the septage return flows within the Los Osos Basin.

A reduction in outflows from upper aquifer (141 AFY) increases likelihood of seawater intrusion. Outflows decrease by 400 AFY w/ more pumping from upper aquifer (see Attachment 32 pp. 3, 4)

Table 10 – Viable Project Alternative 2b Basin Balance Conditions

COMPONENT OF WATER BUDGET	PERCHED AQUIFER	CREEK VALLEY AQUIFER	UPPER AQUIFER	LOWER AQUIFER
PERCOLATION FROM PRECIPITATION AND IRRIGATION	736	430	1,489	0
SEPTIC RETURN FLOW	36	30	44	0
SUBSURFACE OUTFLOW	0	0	- 1,169	0
SUBSURFACE INFLOW	0	166	107	0
LEAKAGE OR SUBSURFACE CROSS FLOW IN	0	103	719	1,205
LEAKAGE OR SUBSURFACE CROSS FLOW OUT	- 737	- 455	- 835	0
SEAWATER INTRUSION	0	0	0	352
LOS OSOS CREEK INFLOW	0	665	0	0
LOS OSOS CREEK OUTFLOW	0	- 60	0	0
WELL PRODUCTION (INCLUDES CONSERVATION)	0	- 870	- 803	- 1,557
WARDEN DRAIN	0	- 9	0	0
WILLOW CREEK OUTFLOW AND EVAPOTRANSPIRATION	- 35	0	0	0
BRODERSON INFLOW	0	0	448	0
AQUIFER INFLOW	**772**	**1,394**	**2,807**	**1,557**
AQUIFER OUTFLOW	**- 772**	**- 1,394**	**- 2,807**	**- 1,557**

ALL TABLE QUANTITIES ARE IN ACRE-FEET PER YEAR

Flows to Willow Creek are reduced by 517 AFY obviously causing as

Analysis of Water Supply Impacts

LOWWP Facilities Construction Impacts

The sewage collection system for each alternative is effectively the same with the exception of sewage pipeline route to the final location of the LOWWP. Each collection system alternative removes septic system effluent discharges from within the prohibition zone. After treatment to a secondary level, the effluent will be conveyed to spray fields proposed for location at the Tonini site and a leach field proposed for location at the Broderson property. During construction of pipelines, pump station, and treatment facilities shallow groundwater may be encountered that requires disposal.

elevations along the bay (C&A, 2000b). The lower rate would allow disposal that would restore shallow groundwater conditions but not require harvest wells to be used to drawdown the water table along the bay. A series of groundwater monitoring wells on the site and downgradient of the site will be installed to measure groundwater levels for the purpose of reducing the rate of disposal if necessary. However, the study speculated that at any discharge rate, there may be increased potential for liquefaction beneath residences immediately downgradient of the disposal area (C&A, 2000b). Broderson leach fields are not certain to percolate effluent at the rate predicted.

To assess the potential for liquefaction impacts to occur, the LOCSD conducted another subsurface investigation in 2004. The study conducted cone penetrometer testing to obtain site specific subsurface data around the area of proposed effluent spreading and downgradient into the adjacent community. The results of the study indicated that the potentially liquefiable soils in the vicinity of the site consisted of unconsolidated loose dune sand deposits contained within the upper 5 to 10 feet bgs. The underlying Paso Robles Formation is weakly indurated and forms a dense soil that has a low potential for liquefaction or seismic settlement to occur as a result of the effluent disposal system and the estimated groundwater mounding beneath Broderson (Fugro, 2004). The LOCSD 2004 study also conducted confirmatory field percolation testing and a prototype percolation line pilot test to provide infiltration data for correlation with the previous 1997 County study, and conducted additional laboratory soil tests to provide data for a preliminary disposal system design.

To assess the potential impacts of effluent disposal at Broderson on the underlying groundwater quality, the LOCSD performed a water quality modeling study in 2003 (Y&W, 2003). The study simulated groundwater quality changes that would result from discharge of treated effluent with an average NO3-N concentration of 7 mg/l. The study concluded that while change would be gradual over time, the removal of septic system recharge in the prohibition area and the return of treated effluent with a reduced nitrate concentration to the Broderson site would result in a beneficial impact that will improve water quality.

Short-term Construction Impacts

The entire Broderson site consists of approximately 75 acres. The leach field area as designed would occupy a rectangular area covering approximately 8 acres and the remainder would be preserved as open-space. The leach field design includes excavation of leach line trenches to an average depth of 6.5 feet during construction and subsequently re-graded. The leach fields would consist of a 4-foot depth of gravel for drainage, covered by a geotextile fabric, and then there would be at least 2.5 feet of native soil backfill. The percolation piping would consist of 4-inch perforated PVC pipe laid with the perforations facing upwards, one foot below the geotextile fabric layer. If

Eight acres of ESHA will be destroyed and redisturbed every 5-10 years (leachfield material excavated and ground beneath disked)

Table 11 - Effluent Water Limitations from Previous Discharge Requirements (Order No. R3-2003-0007)

EFFLUENT LIMITATIONS			
CONSTITUENT	UNITS	MONTHLY AVERAGE	DAILY MAXIMUM
SETTLEABLE SOLIDS	MG/L	0.1	0.5
BOD*, 5-DAY	MG/L	60	100
SUSPENDED SOLIDS	MG/L	60	100
TOTAL NITROGEN (AS N)	MG/L	7	10

*Biological Oxygen Demand

The treatment facilities are being designed to produce an effluent that will have an average NO_3-N concentration of 7 mg/l and an estimated TDS concentration of 620 mg/l (Carollo, 2007b). The average nitrate concentration presently in the Los Osos Basin in the proximity of the prohibition zone groundwater is on the order of 10 mg/l (NO_3-N) (Y&W, 2003) and the average TDS concentration is approximately 330 mg/l (C&A, 2005c).

Effluent disposed at Broderson would have a positive affect on slowing the current conditions of seawater intrusion in the lower aquifer zones and flushing nitrate laden water from upper aquifer zones. The slow turnover rate of groundwater has been identified as the single most important basin characteristic affecting water-quality trends in the Los Osos Basin (Y&W, 2003). This occurs because the volume of groundwater in storage is relatively large compared to annual inflows and outflows. The result is that any action to decrease nitrogen loading (i.e., the LOWWP) will take a relatively long time to have an effect. As a result, nitrate concentrations in some deep wells may continue to increase for many years before the effect of septage removal reaches the lower aquifer system. Recent study has concluded that the shallow aquifer system may take on the order of three decades to equilibrate to a change in nitrate loading (Y&W, 2003). Regardless of the time frame required to realize a reduction in nitrate concentrations across the Los Osos Basin this impact is considered a beneficial impact to the basin.

It will take 30 years for nitrates to be reduced 1.7 mg/l.

To assess the impacts of TDS and NO3-N concentrations in the Los Osos Basin caused by effluent disposal at Broderson, a mass balance calculation was performed using septic return flows, precipitation, irrigation, subsurface cross flows and effluent disposed at Broderson at a rate of 448 AFY. The hydrologic budget

This statement is made prior to purveyors indicating they plan to treat the water for nitrates to increase use.

From the LOWWP Draft EIR, Appendix D-2
(Available at http://www.slocounty.ca.gov/PW/LOWWP)

summarized in Appendix C of this study was utilized for the purpose of comparing current conditions and conditions estimated for the viable project alternatives (C&A, 2008b). A summary of the mass balance calculation results is provided in Appendix D – Water Quality Mass Balance Summary. Combining the average effluent concentration of 7 mg/l with all the other nitrogen sources in the Los Osos Basin the average NO3-N concentrations in the upper aquifer after LOWWP completion will be approximately 8.3 mg/l, and is below the drinking water standard. The nitrate concentration calculation results are included in Table 12 – Summary of Upper Aquifer Nitrate Loading and Average Concentrations.

The resulting average TDS concentration calculated for the upper aquifer zones with the operation of Broderson is provided in Table 13 – Summary of Upper Aquifer Average Total Dissolved Solids Concentration. Both of these results indicate Broderson will provide a beneficial water quality impact on the Los Osos Basin.

Table 12 – Summary of Upper Aquifer Nitrate Loading and Average Concentrations

BASIN CONDITION	TOTAL SURFACE RECHARGE TO LOS OSOS BASIN (AFY)	TOTAL NITROGEN LOAD (TONS)	ESTIMATED AVERAGE CONCENTRATION (MG/L)
CURRENT	3,525	52.1	10.9
BRODERSON 448 AFY	3,337	37.9	8.3
BRODERSON 896 AFY	3,785	42.1	8.2

CONCENTRATION ESTIMATE WITH NO SUBSURFACE DENITRIFICATION FOLLOWING WASTEWATER DISPOSAL

Currently (2005) avg. = 10mg/l *(see Page 2 of this attachment).

Table 13 – Summary of Upper Aquifer Average Total Dissolved Solids Concentration

BASIN CONDITION	BRODERSON DISCHARGE (AFY)	TOTAL SALTS LOAD (TONS)	ESTIMATED AVERAGE CONCENTRATION (MG/L)
CURRENT	0	1,378	352
VPA 2a	448	1,073	296
VPA 2b	448	1,097	299
VPA 2a	896	1,450	343
VPA 2b	896	1,475	345

DEIR, Append. D-2

elevations (see Appendix C) were enlarged on plates that are included in Appendix E – Water Level Contour Maps, to show the area of primary impact to the upper aquifer B and C zones. The resulting impacts of individual VPA components are tabulated in Table 14 – Los Osos Basin Water Level Impacts. The values listed in Table 14 consist of existing conditions and a comparison of simulated conditions upon project startup.

Table 14 - Los Osos Basin Water Level Impacts

PROJECT COMPONENT	UPPER AQUIFER WATER LEVEL ELEVATIONS (FEET)		LOWER AQUIFER WATER LEVEL ELEVATIONS (FEET)		UPPER AQUIFER WATER LEVEL CHANGE (FEET)		LOWER AQUIFER WATER LEVEL CHANGE (FEET)	
	ALONG THE BAY SHORE	MID BASIN	ALONG THE BAY SHORE	MID BASIN	ALONG THE BAY SHORE	MID BASIN	ALONG THE BAY SHORE	MID BASIN
EXISTING CONDITION	5	15 TO 20	-2	-5	NA	NA	NA	NA
SPRAY FIELDS ONLY	0 TO 5	5 TO 10	-5	-5	-2	-8	-2	-3
CONSERVATION ONLY	5	10 TO 15	0 TO -5	-5	-2	-6	-1	-1
BRODERSON ONLY	5	15 TO 20	0 TO -5	-5	0 TO -5	0	0 TO -1	0
AG REUSE ONLY	5	10 TO 15	0 TO -5	-3	-2	-5	-1	-1
VPA 2A	5	15 TO 20	0	0	1 TO -1	0	2	4
VPA 2B	5	15 TO 20	0	0	1 TO -1	0	0 TO 2	2

These results indicate that because Broderson discharge effectively replenishes the B and C zones beneath the perching clay, the upper aquifer water levels are virtually restored to the current condition (C&A, 2008b) (see Appendix E, Plates E1 and E2) from the 448 AFY discharge scenario. Without the Broderson disposal alternative the removal of the upper aquifer system recharge from septic system percolation (i.e., complete disposal of effluent to the Tonini spray fields) would imbalance the hydraulic equation and allow water levels to decline to near or below sea level along the bay shoreline (see Appendix E, Plate E3). The potential impact to fresh water features around the bay (i.e., springs, marshes, etc.) would be significant. In addition, the low water levels in the upper aquifer would create a vulnerability to seawater intrusion and would be a significant impact. As indicated, the potential VPA 2a water supply impacts are less than significant because of the hydrologic budget balance created by the combined project that includes the Broderson disposal site.

The Broderson disposal recharge can not mitigate potential impacts of reduced groundwater outflow that drains out of the upper aquifer A zone toward the Willow Creek drainage or directly into the bay. The annual drainage in the Willow Creek area will be reduced by the LOWWP to natural or above natural conditions prior to the Los Osos community development. Drainage will still occur, however the flow rates may be reduced to the present ephemeral surface flows. The potential impacts of the reduced groundwater discharge in this area of the Los Osos Basin could be realized along the riparian corridors of the drainage features. However, seasonal runoff and shallow groundwater are anticipated to provide sufficient water for use by the riparian vegetation established well before the Los Osos community was developed.

↖ Potential impacts to Willow Creek and other habitat are acknowledged but not mitigated (i.e., the reduction of over 500 AFY of groundwater flows to ESHA).

Hydrogeologic Hazards

Potential hydrogeological hazards identified by this study are focused around the Broderson disposal site. Potential hazards include increased rising groundwater in the community at lower elevations around the bay, groundwater seepage from slope faces below the leach field, or liquefaction of soils between the site and the points of onshore and offshore discharge. Specific studies have been conducted to assess the potential for each of these impacts to occur.

As previously mentioned, water level elevation changes in the vicinity of the site and across the Los Osos Basin in the upper aquifer zones were modeled as part of the project design study. The design capacity of 448 AFY was selected based on the ability of the aquifer system to receive this annual quantity of water without developing adverse conditions. The reduced design capacity alleviates hazards that could be caused by discharge at a higher rate. This rate reduces mounding beneath the site to eliminate the potential for groundwater to flow laterally and exacerbate saturated soil hazards near the bay. The design rate minimizes the potential for additional rising groundwater around the bay at lower elevations. While this condition presently exists in many low lying areas around the bay, the proposed disposal capacity at startup is designed to maintain existing conditions and not exacerbate this potential hazard. Liquefaction is a hazard that was specifically studied by the LOCSD to understand the potential for its occurrence (Fugro, 2004). The result of the field tests indicated that the potential was low because of the nature of the underlying geologic formation which was comprised of dense soils beneath the dune sands.

While project studies indicate that potential risk for these hazards is low, the occurrence of these potential impacts would be controlled during operation by the installation of a monitoring network at the Broderson site and downgradient within the residential community prior to initiating discharge. The groundwater monitoring network would allow direct observation of the changes in groundwater conditions and appropriate adjustments to the disposal operations can be made. In addition, if

Onsite runoff can be minimized by diverting runoff from surrounding areas outside the spray field parcels around the disposal site.

- The designed operation of the Broderson disposal alternative at the approximate capacity of 448 AFY (or greater) would reduce the potential impact of groundwater recharge losses that will result from the LOWWP elimination of septic system recharge to the main aquifers that provide water for overlying beneficial uses in the Los Osos Basin to less than significant.

- Potential geologic hazards arising from groundwater conditions created by operation of the Broderson leach field disposal will be controlled through the proper design and use of a monitoring network to track the occurrence and movement of water beneath the site and downgradient of the site. This monitoring component of the Broderson disposal alternative would allow verification that these potential impacts remain less than significant.

- The potential impact on the exact quantity of groundwater in the perched aquifer is unknown and the potential impact on groundwater flow to surrounding surface water features is speculative given that the amount of perched groundwater currently flowing to surface water features is not known.

- The proposed disposal of treated effluent at Broderson would reduce the current rate of seawater intrusion into the lower aquifer, thus resulting in a beneficial impact.

- Analyses indicates that disposal at Broderson will reduce nitrate loading and result in a beneficial impact on nutrient concentrations in the basin.

- The salinity of the upper aquifer recharge from septic system effluent is the same as the treated effluent discharge proposed at Broderson and the groundwater replenishment resulting from this discharge will have a less than insignificant impact to existing salt balance conditions in the basin.

- The TDS concentration of treated effluent that would be used for sprayfield disposal at the Tonini Ranch is estimated at approximately 620 mg/l and is comparable to the groundwater that underlies the Tonini site. Because of the similar TDS concentrations, the effects on groundwater from using the LOWWP effluent as an irrigation source versus pumping groundwater for crop irrigation are the same. Based on these conditions

From: Appendix A of DEIR
Appendix D-2

HOPKINS
GROUNDWATER
CONSULTANTS

- CREEKS
- SURFACE WATER FEATURE

NORTH
0 1000 2000
FEET

MARSH LOCATION BASED ON FRESHWATER INFLUENCES ON MORRO BAY, TMS, TES, 1980

SURFACE WATER FEATURES
LOCATION MAP
Hydrogeological Impacts Analysis
LOWWP Draft EIR
San Luis Obispo County
Los Osos, California

PLATE A1

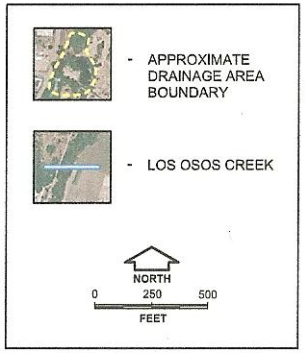
October 2008
Project No. 07-016-01

DEIR, Appendix A
(of Appendix D-2)

October 2008
Project No. 07-016-01

HOPKINS
GROUNDWATER
CONSULTANTS

~500 AFY of groundwater will stop flowing to Willow Creek Drainage. These flows support Eto Lake, Los Osos Creek, (steelhead habit), and the estuary.



WILLOW CREEK DRAINAGE
Hydrogeological Impacts Analysis
LOWWP Draft EIR
San Luis Obispo County
Los Osos, California

PLATE A2

From: Appendix A of DEIR Appendix D-2

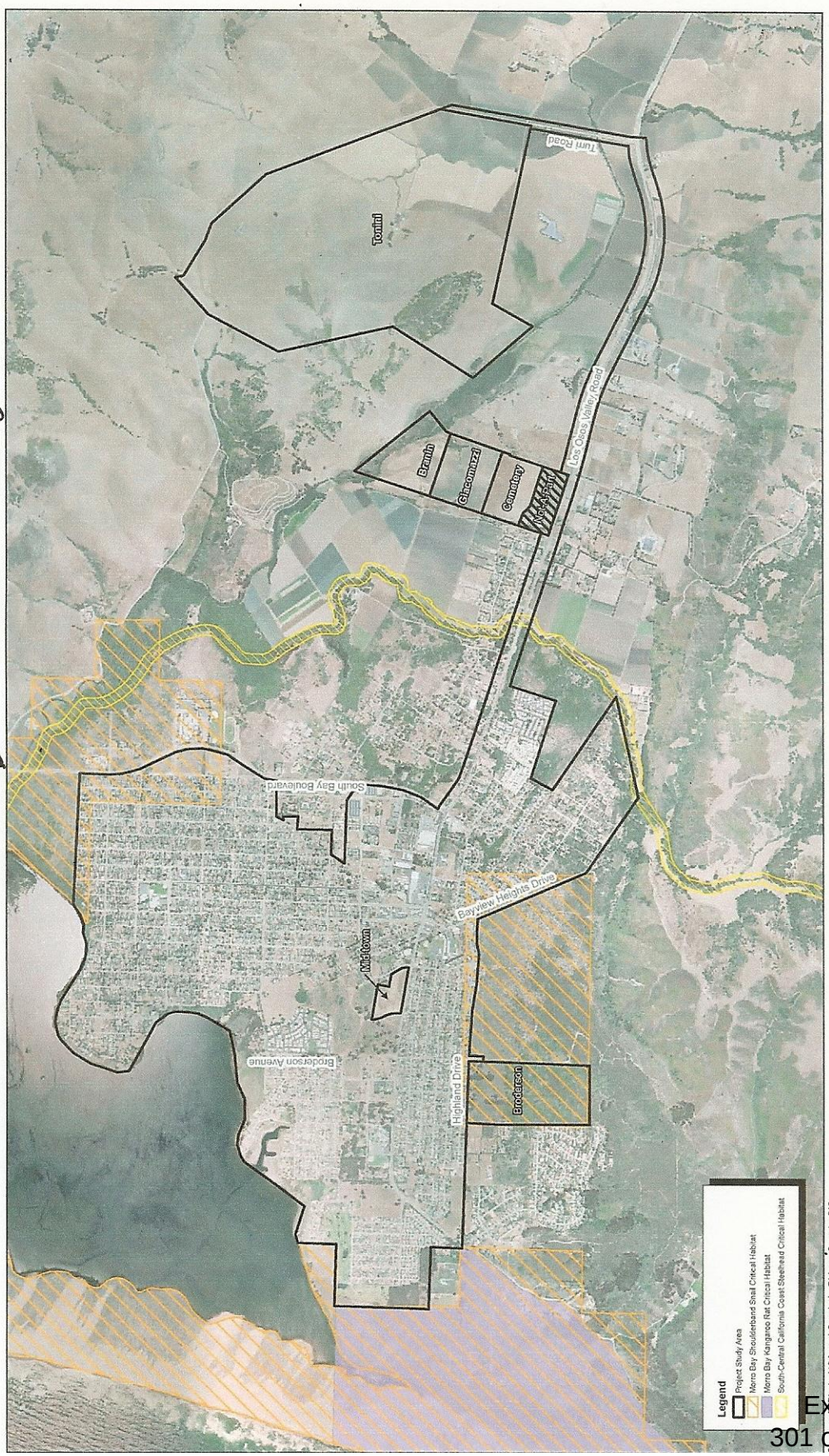
HOPKINS
GROUNDWATER
CONSULTANTS

This shows the perched aquifer reaching E to Lake and LO creek, suggesting greater impacts to this habitat than reported in the EIR.

The EIR states that impacts will be greatest on willow Creek Drainage (circled) w/the reduction of flows from the perched aquifer.

DEIR

Los Osos Creek and Los Osos Creek estuary are steelhead habitat.



Source: Pictometry Photo USA and San Luis Obispo County GIS

Mintier & Associates

0224002 • 11/2008 | 5.5-1_special_status_habitat.mxd

Exhibit 5.5-1
Special Status Species Habitat

COUNTY OF SAN LUIS OBISPO • LOS OSOS WASTEWATER PROJECT
ENVIRONMENTAL IMPACT REPORT

Table D6 - TDS Loading, UAS, Broderson (Current Conditions)

WATER SOURCE	TOTAL VOLUME (AFY)	CONCENTRATION (MG/L)	TOTAL LOAD (TONS)
SEPTAGE	606[1]	620[3]	511
PRECIPITATION	1,129[2]	0	0
IRRIGATION	360[2]	868[4]	425
LK/SCF[7] FROM PERCHED	698[1]	399[5]	379
LK/SCF[7] FROM CC[8]	90[1]	520[6]	64
TOTAL ANNUAL LOAD TO SYSTEM (TONS)			1,378.0
TOTAL VOLUME OF DISCHARGE TO GROUNDWATER (AFY)			2,883
ESTIMATED CONCENTRATION OF DISCHARGE TO GROUNDWATER (MG/L)			352

1 - CLEATH, 2008
2 - CALCULATED BASED ON TABLE 4 (YATES AND WILLIAMS, 2003)
3 - FINE SCREENING REPORT
4 - ESTIMATION BASED ON IRRIGATION WATER AT 330 MG/L TDS WITH 62 PERCENT ET AND 38 PERCENT PERCOLATION
5 - ESTIMATION FROM TABLE 1
6 - CLEATH, 2005c
7 - LEAKANCE/SUBSURFACE CROSS FLOW
8 - CREEK COMPARTMENT

Table D7 - TDS Loading, UAS, Broderson (VPA2a)

WATER SOURCE	TOTAL VOLUME (AFY)	CONCENTRATION (MG/L)	TOTAL LOAD (TONS)
SEPTAGE	44[1]	620[3]	37.1
PRECIPITATION	1,129[2]	0	0
IRRIGATION	360[2]	868[4]	424.9
LK/SCF[7] FROM PERCHED	634[1]	229[5]	197.4
LK/SCF[7] FROM CC[8]	51[1]	520[6]	36.1
BRODERSON	448[1]	620[3]	377.7
TOTAL ANNUAL LOAD TO SYSTEM (TONS)			1,073.1
TOTAL VOLUME OF DISCHARGE TO GROUNDWATER (AFY)			2,666
ESTIMATED CONCENTRATION OF DISCHARGE TO GROUNDWATER (MG/L)			296

1 - CLEATH, 2008
2 - CALCULATED BASED ON TABLE 4 (YATES AND WILLIAMS, 2003)
3 - FINE SCREENING REPORT
4 - ESTIMATION BASED ON IRRIGATION WATER AT 330 MG/L TDS WITH 62 PERCENT ET AND 38 PERCENT PERCOLATION
5 - ESTIMATION FROM TABLE 2
6 - CLEATH, 2005c
7 - LEAKANCE/SUBSURFACE CROSS FLOW
8 - CREEK COMPARTMENT

Identifying the Sources of *Escherichia coli* Contamination to the Shellfish Growing Areas of the Morro Bay Estuary

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ACKNOWLEDGMENTS

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LIST OF ACRONYMS AND ABBREVIATIONS

Cal Poly	California Polytechnic State University, San Luis Obispo
CCRWQCB	Central Coast Regional Water Quality Control Board
DHS	California Department of Health Services
E. coli	*Escherichia coli* bacteria
MBNEP	Morro Bay National Estuary Program
MBSTAC	Morro Bay Shellfish Technical Advisory Committee
MF	Membrane Filter
Morro Bay	This will mean the actual bay and not the city of Morro Bay unless specified.
MPN	Most Probable Number
NPDES	National Pollutant Discharge Elimination System
NPS	Non Point Source
NSSP	National Shellfish Sanitation Program
SLOCH	San Luis Obispo, County Health
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
UW	University of Washington
WSF	William Shellfish Farms

INTRODUCTION

Fecal coliform bacteria, common in the intestines of warm-blooded animals, are used as an indicator of fecal contamination in the environment that might include disease causing bacteria and viruses. The California Department of Health Services (DHS) has been monitoring fecal coliform levels in Morro Bay for the protection of shellfish since 1953. Unmanageable levels of fecal coliforms above the legal allowable limit in recent years have resulted in a reclassification of portions of the shellfish lease area from "C*onditionally Approved*" to "*Prohibited*" for shellfish harvesting (Figures 1 and 2). The Morro Bay certified shellfish grower is required to stop harvesting and is closed when a 24-hour rainfall exceeds 0.40 inches of rain. Depending on the harvest location closure may last from five to twelve days. If bacterial levels continue to rise, additional harvest restrictions may be placed on the shellfish grower. The National Shellfish Sanitation Program (NSSP) standard for a "C*onditionally Approved*" shellfish growing area is a fecal coliform sample below a geometric mean of 14 MPN/100 mL and below a 90th percentile of 43 MPN/100 mL. Samples for fecal coliform are taken during open harvest conditions. Rising levels of bacteria may also adversely impact recreational activities in the bay. The Regional Water Quality Control Board's (RWQCB) Water Quality Control Plan (Basin Plan 1994) standards for Water Contact Recreation for fecal coliform are 200 MPN/100 ml (log mean of a minimum of five samples). Elevated levels of fecal coliforms are an indication that the bay may be unsafe for swimming and other forms of water contact activities.

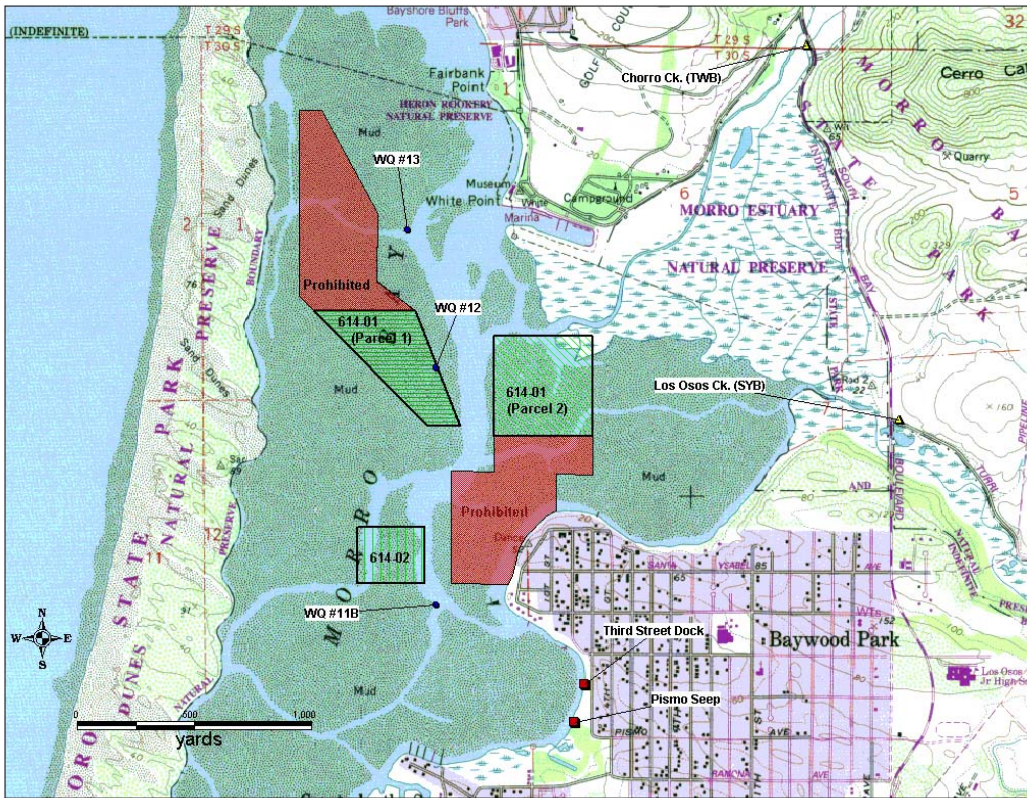

Figure 1. Map of Morro Bay (DHS). The polygons represent potential growing area leases. The small dots show where the DNA sites are: Chorro Creek, Los Osos Creek, 13, 12, 11B, Third Street Dock Seep and Pismo Seep.

Potential sources of bacteria include agricultural runoff, domestic animal waste, leaking/failing septic systems, terrestrial and marine wildlife, discharge from recreational and commercial boats and boating facilities, urban runoff, leaking lift stations and faulty wastewater treatment plant operations. Some of these sources may discharge only during storms, while others are discharged to the bay year-round. Other sources may discharge bacteria to the bay continuously through the creeks and groundwater sources (seeps) that feed the bay. Historically, fecal coliform levels have been high in Chorro and Los Osos Creeks directly above the confluence with the estuary, in Cuesta and Baywood Park inlets and the northern region of the oyster harvesting area (across the bay from the state park marina) within the estuary.

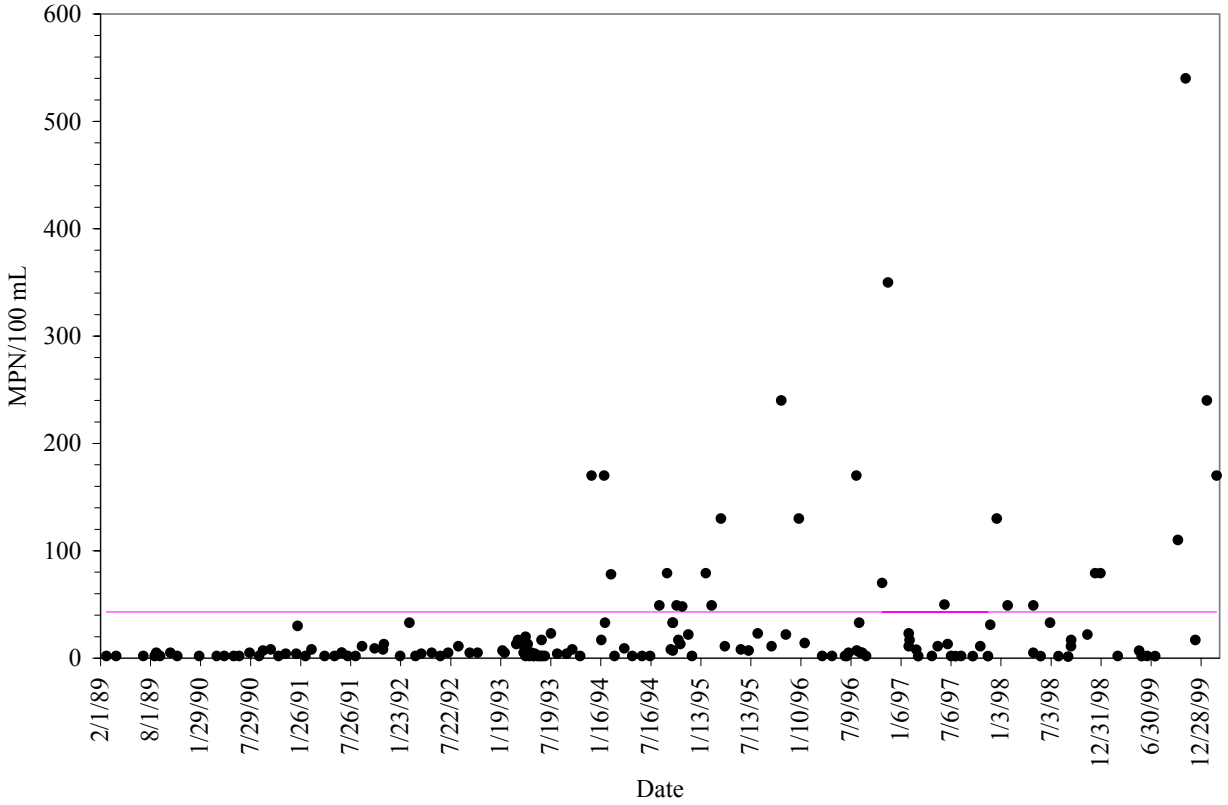

Figure 2. Historical fecal coliform counts (MPN/100 mL) at Bay Site 13 (DHS). The red line indicates the NSSP limit of 43 MPN/100 mL.

The Shellfish Protection Act of 1993 (California Water Code Sections 14950-58) requires Regional Water Quality Control Boards to assemble a Technical Advisory Committee when a body of water is "threatened" on the basis of a downgrade in classification. In 1996 DHS reclassified a portion of lease M-614-01, Parcel 1 to "Prohibited" (Figures 1 and 2), and notified the Central Coast Regional Water Quality Control Board (CCRWQCB). In response, the CCRWQCB established the Morro Bay Shellfish Technical Advisory Committee (MBSTAC) in 1997 to conduct water quality investigations and develop remediation strategies for the shellfish growing area.

This project involved microbial source tracking to identify the origins of bacterial contamination to the estuary. The project was developed and directed by the MBSTAC and carried out as a cooperative effort between the University of Washington (UW), California Polytechnic State University (Cal Poly) and the CCRWQCB and funded by the California State Water Quality Control Board. The study consisted of three sampling efforts that lasted over a two-year period. In one portion of the study more than 1600 *E. coli* strains (a typical fecal coliform bacterium) were isolated from the samples. Genetic fingerprints known as ribotypes were used to compare the isolated bacteria to a library of bacteria isolated from the feces of different animals. Matches between isolated *E. coli* from Morro Bay and bacteria in the UW library were used to create a breakdown of the possible fecal sources of *E. coli* in Morro Bay. This sampling effort included three bay sites, both creek mouths and two seeps as well as bay sediment and oysters. The second sampling effort covered a wide area in the Morro Bay watershed and only total and fecal coliform counts were taken. A third sampling effort covered a grid area around the "Prohibited" portion of lease M-614-01, Parcel 1, and only included total and fecal coliform counts. The results of this study will be used by the MBSTAC to consider further recommendations to the CCRWQCB concerning the threatened status of the shellfish growing area and will help to guide policy decisions designed to control fecal contamination in Morro Bay.

PAST WORK

A Clean-up and Abatement Study funded by the State Water Resources Control Board (SWRCB) was conducted to characterize all the potential sources of bacterial contamination of Morro Bay during wet and dry weather conditions (Jagger *et al*., 1987). This study characterized bacterial levels throughout the bay and potential sources of contamination. Results indicated that certain regions of the bay had elevated fecal coliform counts, particularly the southern end. A detailed study of the possible fecal inputs to Morro Bay was recommended as a result of these findings.

As part of the CCRWQCB's National Monitoring Program, water quality data, such as fecal coliform, has been collected from several locations at regular intervals throughout the Morro Bay watershed under a sampling scheme in place since 1993. Biweekly sampling occurs year-round with weekly sampling occurring during a twenty-week period every winter. Sampling has been effective at detecting elevated fecal coliform levels at various sites throughout Chorro Creek and Los Osos Creek watersheds.

The Morro Bay National Estuary Program (MBNEP) and the CCRWQCB collected bacterial samples during the "first flush" winter rains of 1995-96 and 1996-97. Extremely elevated levels of fecal coliform (> 900,000 MPN/100ml) were found in samples taken from gutters, culverts and storm drains throughout Morro Bay and Los Osos.

The DHS has been monitoring fecal coliform levels in Morro Bay for the protection of shellfish since the 1980's. Due to the unpredictable nature of the bacterial levels found in the bay in recent years, portions of the lease area have been reclassified from "Conditionally Approved" to "Prohibited" for oyster harvesting. Sporadic spikes in bacterial levels greater than the National Shellfish Sanitation Program (NSSP) limit of 43 MPN/100 mL have occurred during times of no rainfall and cannot be attributed to run-off from the surrounding area.

In response to elevated levels found by the DHS, the MBNEP and CCRWQCB began conducting reconnaissance sampling in the bay in 1996. This pilot sampling effort was geared towards assessing trends in the bay's water quality and further identifying possible sources of contamination. Data from these sample sites show that bacterial levels have been continually high at sample sites in Cuesta Inlet and Baywood Park Inlet near Los Osos, particularly during the wet season. Elevated fecal coliform levels have been continuously found in four freshwater seep sample sites, reaching 28,000 MPN/100ml at one location.

The Morro Bay National Estuary Program funded a Bacterial Loading Study to quantify loadings and impacts through the development of a numeric model (Tetra Tech, 1999). The results of the model simulations indicated that nearly half of the loading to the estuary comes from Chorro Creek, and during the wet weather, flow from Chorro Creek impacts the shellfish growing areas. According to Tetra Tech, groundwater sources have limited impacts on shellfish growing waters during the wet season, but were found to have impacts on shoreline areas in the south bay during dry weather. During wet weather periods, runoff from Los Osos had impacts to the southern most shellfish growing area.

NEED FOR THE STUDY AND USE OF RESULTS

Williams Shellfish Farms (WSF), which is comprised of two Department of Fish and Game water bottom leases in Morro Bay, totals 288 acres. About 156 acres, or 54% of the total are classified as "Prohibited". These acres also represent the best growing area in the bay. Fecal coliforms are an indicator that disease causing bacteria and viruses may be present in the environment. Increasing levels of fecal coliforms are adversely impacting commercial uses of Morro Bay. The certified shellfish growers, have had to adapt their operation on the bay to ensure their shellfish meet water quality standards. They shut down for many days after rainfall and cannot harvest on portions of their lease area that have been closed, causing severe economic hardship for WSF. Some 46% of the lease area is classified as "Conditionally Approved" with a 0.4" rainfall closure for 5-12 days. This condition almost insures constant closure through a typical winter. This has caused WSF to reduce its operation and lose money. WSF is not buying a quantity of seed oysters it could utilize to grow out on all of its leasehold. Additionally, WSF has lost sales locally where many people are aware of the pollution problem. Since water quality appears to be declining, further restrictions to the shellfish growing area classifications are possible. Any additional restrictions may be cost prohibitive for the local grower.

Increasing levels of bacteria could also have a negative impact on many recreational activities in the bay. Due to elevated levels found in the bay in recent years, sampling has been conducted by the County Health Department and the CCRWQCB. Fecal coliform samples have been taken to ensure popular recreational areas meet the water contact standards for activities such as swimming, wading and kayaking. In the past, some samples have exceeded CCRWQCB Basin Plan standards for recreational contact.

As stated earlier, sampling parameters such as fecal coliforms, including *E. coli,* are indicators that disease-causing bacteria may be present. These parameters are used by state and federal agencies to set both shellfish and recreational standards for water quality. Sampling to date has relied upon these indicators to assess the existence of harmful bacterial contamination. However, many of these parameters are not only present in human waste, but in waste from other

warm blooded animals. Given the existence of many different animals in the watershed and estuary that harbor *E. coli*, it is impossible to define the sources of contamination by simply counting fecal coliforms.

Because the sources of fecal coliform bacteria in Morro Bay are numerous, management of land use and activities in the watershed and estuary is extremely difficult. The results of this study will aid in determining the sources of fecal coliform contamination (e.g. cattle or human) and thus help to prioritize water quality improvement actions (e.g. intensive grazing management or improved wastewater treatment) in the Morro Bay watershed. This study will provide local agencies with information to protect numerous beneficial uses, such as contact and non-contact recreation and shellfish harvesting. Managers will have scientific information to direct limited and valuable resources towards actions that most effectively reduce bacterial levels in the bay.

The CCRWQCB's Shellfish Technical Advisory Committee will use results of this study to make recommendations and prioritize areas for implementing management measures. The results of this study will also be incorporated into a Total Maximum Daily Load (TMDL) for pathogens in Morro Bay.

STUDY OBJECTIVES AND ASSUMPTIONS

Primary Objectives:

- To identify the sources of bacterial contamination which threaten the shellfish harvesting waters of the Morro Bay estuary.
- To ascertain these contributions separately for both wet and dry seasons.
- To ascertain differences in these source contributions for individual sites around the bay.

Secondary Objectives:

- To identify the sources of bacterial contamination which threaten water-contact recreation in the Morro Bay estuary.
- To expand the database of fecal coliform strains and their fingerprints that can be used in this and later studies to identify the sources (i.e. human, cow, bird) of bacterial contamination in other regions.

The assumptions that may be a part of this study include, but are not limited to the following:

- The results of the study are only as accurate as the library. That is, the origin of an *E. coli* strain can only be determined if a corresponding strain exists in the library.
- The chance that all unidentified strains of *E. coli* are from the same source is very small.
- The study does not account for the geographical location of the *E. coli* source, only the species of animal that the *E. coli* came from.
- *E. coli* concentrations and/or sources do not necessarily represent fecal concentration, pathogen concentration or pathogen type and so interpretation of this study is limited to analysis of the distribution of viable *E. coli*.

STUDY DESIGN

Introduction

The work done in this study was separated into three sampling efforts. The first sampling effort was focused on the major thrust of the study; tracking sources of *E. coli* around the bay. The other two sampling efforts consisted of MPN analyses of total and fecal coliforms. The second sampling effort involved collecting water samples around the Morro Bay watershed and sampling times were coordinated with the collection of samples for *E. coli* source tracking. The watershed sampling was designed to compliment the study of source tracking and to provide data for the CCRWQCB's TMDL for Morro Bay. The third sampling effort consisted of a grid of sampling sites surrounding the "Prohibited" section of lease M-614-01, Parcel 1. This last effort was directed at understanding the distribution of fecal coliform in the bay during dry weather for DHS management of the shellfish lease areas.

Tracking the sources of *E. coli* using ribotyping

Within the species of bacteria known as *Escherichia coli* there are many different strains, each of which has their own specific characteristics. For example, some strains can cause disease, and others are considered harmless. There are several methods in the literature for identifying different strains of *E. coli* and tracking sources in the environment[1]. The one chosen for use in this study is termed ribotyping because it uses the position of the ribosomal RNA genes (called rDNA) in the *E. coli* genome to create a strain specific pattern. This pattern looks rather like a supermarket bar code and can be used to compare to two cultures of *E. coli* to see if they derive from the same original strain. As methods for differentiating strains of bacteria have emerged it has become possible to determine whether *E. coli* strains have a preference for the intestines of specific host animals. Several recent studies shown a clear correlation between *E. coli* strains found in feces and the host animal source of those feces[1]. Thus, a new method for understanding fecal contamination in the environment has been applied. It is now possible to collect *E. coli* from the environment, make strain patterns, ribotypes for example, and compare them to patterns from a library of *E. coli* strains that were collected from animal feces. In this way, depending on the size of the library, the source of the *E. coli* in the environment can be determined in terms of what animal left feces that leaked bacteria into a given sample. Clearly the key issue in this kind of study is the size and composition of the *E. coli* library. The University of Washington's School of Public Health has an extensive library of *E. coli* ribotypes (>75,000) from strains that were isolated from the feces of scores of different animals. This made UW an obvious choice for collaborating in this study of the sources of fecal contamination in Morro Bay.

Library source sampling

Cal Poly was tasked to collect between 220 and 500 fecal samples (or 1000 strains) from all potential sources of contamination to the Morro Bay estuary. The existing library at UW

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[1] Kaspar, C.W., Burgess, J.L., Knight, I.T., and Colwell, R.R. (1990) Antibiotic resistance indexing of *Escherichia coli* to identify sources of fecal contamination in water. Can. J. Microbiol. 36: 891-894.
Carson, C.A.; Shear, B.L., Ellersieck, M.R., and Asfaw, A.. (2001) Identification of Fecal *Escherichia coli* from Humans and Animals by Ribotyping. Appl. Environ. Microbiol. 67(4): 1503-1507.
Dombek, P.E., Johnson, L.K., Zimmerley, S.T., and Sadowsky, M.J. (2000) Use of Repetitive DNA Sequences and the PCR to Differentiate *Escherichia coli* Isolates from Human and Animal Sources. Appl. Environ. Microbiol. 66(6): 2572-2577.

contained strains from California, however, the library had no local source samples from the study site. As particular strains of *E. coli* can be localized, the intent of the local source sampling in the Morro Bay estuary watershed was to increase the percent of the total identified strains attributed to any particular source. Samples collected for increasing the library of sources were to include representative samples from four main categories of organisms; humans, birds, domestic mammals, and wild mammals (Table 1). These categories include dogs, cats, cattle, sheep, birds, raccoons, horses, deer, marine mammals, and humans. Additionally, samples were to be collected from the California Men's Colony wastewater treatment plant in the Chorro Creek watershed. The target distributions of source samples approved by the MBSTAC are shown in Table 1.

For all non-human sources samples taken, the genus name and often the species epithet were documented (time and location) and verified visually. Human sources were collected voluntarily or from wastewater treatment plants in the watershed, whereas domestic mammal sources were collected courtesy of local animal owners. Birds and wild mammal sources were collected in extensive field outings in which an animal was tracked visually and fecal matter collected individually so visual identification could be made for each source sample. No more than three samples were collected from the members of the same animal species from a given location. Only a single sample was collected from an individual animal. All samples were collected using Culturette EZ collection and transport systems (Becton and Dickson Microbiology Systems, Sparks, MD USA). All samples collected and returned to Cal Poly State University were immediately placed on ice and chilled to 4°C until shipped to UW (within 48 hours after collection) for ribotyping and addition to the *E. coli* strain genetic library. All sample containers were labeled with the following information: Sample type, host species, sample date and time, sample location, and sampler's initials. All sample information was logged into a field log.

Table 1. Target distribution of library source samples used for ribotyping in this study.

Total Wild Mammals	**62**	**Total Humans**	**125**	**Total Domestic Mammal**	**178**	**Total Birds**	**135**
Deer	13	Los Osos	25	Cow	93	Gulls	35
Raccoon	5	Morro Bay	25	Horse	25	Egret	5
Ground squirrels	5	Waste Water Treatment	25	Sheep	10	Pelican	10
Sea Lions	6	Other	25	Dogs	40	Ducks	15
Harbor seals	10			Cats	10	Coots	25
Otters	3					Cormorants	10
Mice	5					Herons	5
Red Fox	5					Sand Pipers	15
Rabbits	5					Brandts	15
Opossum	5						

Total Samples = 500

Sampling, Isolation and Enumeration of E. coli

Cal Poly collected samples for ribotyping with assistance from members of the MBSTAC and the San Luis Obispo Regional Water Quality Control Board. Samples were collected during five separate events [two (2) dry season weather events and three (3) rainfall events]. The MBSTAC selected sampling sites for ribotyping within the study region (Table 2).

Table 2. List of sites where samples were taken for ribotyping (see Figure 1.)

Ribotype sites
Chorro Creek (@TWB)
Los Osos Creek (@SYB)
Bay Site 11B
Bay Site 12
Bay Site 13
3rd Street Dock Seep
Pismo Seep

Dry weather sampling was conducted during periods when all "Conditionally Approved" growing areas were open for harvest. Dry sampling events were defined as either before the beginning of the rainy season (summer–early winter) or after the effects of the rainy season had subsided (late spring–early summer). The dry season sampling periods were chosen according to historic periods of high coliform counts, rather than by calendar events (e.g. holidays). Water samples for ribotyping were collected during three wet season events occurring in winter-spring 1999-2001. For this study, a rainfall event was defined as a storm with precipitation greater than 0.4 inches of rain within a 24-hour period. Each wet sampling event consisted of two sampling days: the first and third day of the shellfish harvesting area closure. The first wet sampling event also included the first day the shellfish harvesting areas are re-opened but this practice was discontinued due to low coliform counts.

Fecal coliform bacteria were isolated and enumerated using membrane filtration. Ten (10) water samples (100ml for the wet sampling and 1 liter for dry sampling events) were collected and sent to a California Department of Health Services certified laboratory, BIOVIR Laboratories, for filtration and incubation of filters for growing the fecal colonies[2]. The entire set of MF counts is presented in Appendix A. The CCRWQCB provided shipping of the samples to BIOVIR. Membrane filters with between 1 and 16 isolated colonies were sent to UW for isolation and identification of *E. coli* strains before ribotyping.

In addition to water samples, Cal Poly collected a total of 10 oysters (increased from 5 after the first dry/wet events) and 10 sediment samples from the three bay sites (sites 11B, 12, 13) for the dry and wet weather events listed above. Oysters were "planted" at 6-12 inches depth by WSF at the site location prior to the initiation of the study to provide the oysters time to absorb bacteria representative of the locale. These samples (live oysters and 100ml samples of sediment) were sent directly from Cal Poly to UW for plating and isolation of *E. coli* strains.

On February 27th, 2001, the MBSTAC also committed to sampling the fresh water seeps on the Los Osos side of Morro Bay for *E. coli* ribotyping in an attempt to characterize the impact of the seep sources of *E. coli* to the bay. Two freshwater seeps (Pismo Seep and 3rd Street Dock Seep) were sampled 20 times by Cal Poly over random days between June 1 and August 30, 2001 for a

[2] American Public Health, "Recommended Procedures for Examination of Seawater and Shellfish" Edition IV, 1970.

total of 40 samples. Water was sampled, filtered and colonies were grown and isolated for ribotyping according to the methods described above for the bay sites. Seep samples with more than five (5) colonies per filter were sent to UW for ribotyping.

Ribotyping Methodology

Sample arrival and logging

Upon arrival, all samples were inspected for damage to sample containers or microbiological plates, and signs of contamination. Sample identifiers were also checked against the chain of custody papers. The provider's sample identification number, provider ID, sample type, study ID, sample site, sample collection date, and sample arrival date were logged.

Isolation, identification and purification of *E. coli* strains samples

Water samples were received in the form of membrane filter coliform (MF) plates, fecal and sediment samples arrived in specimen containers and oyster samples arrived either in their shells or as a mixed puree in a sample container. Fecal, sediment and oyster samples were plated on MacConkey agar and incubated at 35°C, overnight. The next day 3-5 lactose fermenting, non-mucoid colonies are picked and replated on MacConkey agar for purification. Water samples, had been previously plated on mFC plates. From each sample's MF plate, 3-5 non-mucoid blue colonies were picked and plated on MacConkey agar for purification. At this stage each of the colonies picked from a given sample bore the provider Sample ID number and an accession letter. A single, well isolated, non-mucoid colony was picked from each MacConkey plate and plated on Tripticase Soy Agar. After overnight incubation at 35°C, each culture is tested by the spot indole test using appropriate positive and negative controls. Indole positive cultures are further tested for the ability to utilize citrate using the Simons Citrate media. *E. coli* colonies were identified as indole positive and citrate negative and were given isolate numbers. A portion of each *E. coli* strain isolated from the samples was stored at -80° C , in nutrient broth plus 15% glycerol.

Genomic DNA isolation and restriction endonuclease digestion

Confluent growth was scraped with a sterile flat-headed toothpick and suspended in 200 µl of 50 mM Tris, 50 mM EDTA (pH 8.0). 600 µl more of 50mM Tris, 50 mM EDTA were then added and the suspension was thoroughly mixed by pipetting up and down. 45 µl 20% sodium dodecyl sulfate (SDS) and then 10 µl proteinase K (20 µg ml-1; Pharmacia, Piscataway, N.J.) were added. The solution was then incubated for 1 hour at 40° C. After an equal volume of phenol was added to each tube the samples were vortexed and centrifuged for 5 minutes. The top layer was extracted and an equal volume of chloroform was added. After vortexing again, the preparation was then centrifuged and extracted. Two and one-half volumes of absolute ethanol were added and the DNA was precipitated out and spooled onto a glass capillary pipette. The DNA was washed with a few drops of absolute ethanol, dried, and re-suspended in 50 µl dH2O.

Restriction endonuclease digestion reactions were set up using *Eco*R1 and *Pvu*II, 10 units (Boehringer Mannheim GmbH, Germany) using 2 µl DNA as instructed by the manufacturer. They were incubated overnight at 37°C. The samples were centrifuged and 0.5 µl of enzyme was added. The samples were re-incubated at 37° C for a minimum of three hours. They were centrifuged again and 3 µl of stop dye was added.

Gel electrophoresis and Southern hybridization

Samples were run on an 0.8% agarose gel in 1X Tris-borate-EDTA at 22 volts and 17 milliamps for 17 hours. λ *Hind*III was used as a size-standard along with a known E. coli isolate designated as 3915. The DNA fragments were then transferred to a Nitran filter (Schleicher & Schuell, Keene, N.H.), baked at 80° C for one hour and probed with 32 P-labeled copies of *E. coli* ribosomal RNA. These copies which were made by an extension of random hexanucleotide primers using Avian Myeloblastosis Virus reverse transcriptase (Stratagene, La Jolla, Ca) under conditions specified by the supplier. Hybridization was done in 5X SSC (1X SSC is 0.15 M NaCl plus 0.015 M sodium citrate), 0.1% SDS, 1 mM EDTA, and 50% formamide at room temperature overnight. Salmon sperm DNA and blocking reagent, (Boehringer Mannheim GmbH, Germany) were used to block non-specific binding. Three washes were done with a solution of 2X SSC and 0.1% S.D.S., once at 25 °C for 20 minutes and twice at 65° C for 20 minutes to wash off low-homology, non-specific binding. Blots were then exposed with an intensifying screen to X-ray film (Kodak, Rochester, N.Y.) for 24 hours at -70° C (Figure 3). Two to three exposures were done to ensure all possible bands would show up.

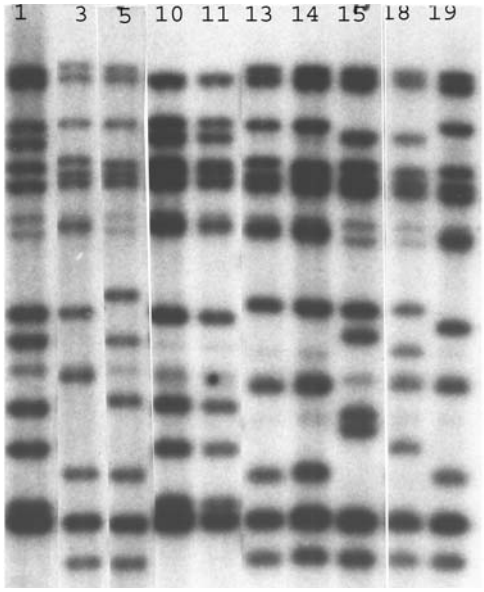

Figure 3. Example X-ray film visualization of *E. coli* ribotypes generated after *Pvu*II digestion and Southern blot. The numbers indicate different strains of *E. coli*. Strains marked 10 and 11 serve as an example of matching ribotypes.

Ribotype Analysis

Molecular characterization was then done on individual *E. coli* strains by assigning a numerical pattern to each ribotype based on the distance between the bands. The autoradiograms were analyzed manually. The restriction fragment polymorphism pattern for each ribotype was converted into a numerical pattern. Bands that were more than 3 mm apart were counted as singles while bands that were within 3mm of each other were counted as doubles or triples. (i.e. two bands that were closer than 3mm were designated "2" and a group of three bands with 3 mm or less between each band was designated "3") Each unique banding pattern was called a ribotype and assigned an alphanumeric pattern. Two isolates that had the same numeric value but different banding patterns were assigned letters to differentiate the two ribotypes. For example, two isolates may have numerical pattern, of 2122111, but the bands may be shifted so the two isolates do not have identical banding patterns. They would be labeled 2122111A and 2122111B. The ribotypes were then entered into a Microsoft Access database. *Pvu*II- and *Eco*R1-generated ribotypes were analyzed both separately and together. Based on their single or multiple ribotypes, the isolates were divided into ribogroups. Analysis of the ribogroups and the isolate source data (fecal samples) allowed for determination of host-specificity.

MPN counts of Total and Fecal Coliforms

Bay sampling

In conjunction with sampling for genetic fingerprinting, water, oyster and sediment samples were collected by Cal Poly for total and fecal coliform counts [multiple tube fermentation method to obtain the most probable number (MPN)[3]]. Bay sampling sites are provided in Table 3. Dry season sampling events consisted of two days sampled 48 hours apart (e.g. Monday and Wednesday). Wet sampling events for MPN consisted of four sampling days: the first, second, and third day of the shellfish harvesting area closure, and on the first day the shellfish harvesting areas were re-opened. Oysters and sediment samples (numbers of samples identical to the ribotyping effort) were collected only on the same days that samples were collected for ribotyping. The oyster and sediment samples were homogenized prior to inoculating the fermentation tubes. The MPN sampling protocol was approved by the MBSTAC with analyses funded by the SWRCB. Cal Poly coordinated the sample collection efforts, collected samples, put them on ice and delivered them to the CCRWQCB, which provided shipping of the samples to one of the following California Department of Health Services certified laboratories: BioVir, Benicia; Creek Environmental, San Luis Obispo; San Luis Obispo County Health, San Luis Obispo; BC labs, Bakersfield. Bay samples were sent to shellfish certified labs only (BioVir and San Luis Obispo County Health). The collection effort for MPN samples was coupled with sampling for ribotyping for the five DNA sampling sites (Table 3). The complete set of MPN counts from the bay sampling sites are presented in Appendix B.

Table 3. List of sites where samples were taken for MPN analysis of total and fecal coliform in Morro Bay.

Bay Sampling Sites
3rd Street Dock Seep
Pismo Seep
Bay Site 7
Bay Site 13
Bay Site 11
Bay Site 11a
Bay Site 11b
Bay Site 12
Bay Site 13a
Bay Site 13b
Bay Site 13c
Bay Site 13d
Baywood Park Inlet
Channel Marker 4
Channel Marker 12
Creek Mouth
Cuesta Channel Marker
Cuesta Inlet
Grassy Island Channel
Bay Mouth
Sand Spit Channel
Shark Inlet

[3] Standard Methods, 18th Edition, 9221b,e

Watershed sampling

In addition to the MPN samples collected in the bay during dry and wet events, there was a coordinated effort with the CCRWQCB to collect water samples for MPN analysis throughout the Morro Bay watershed. Sample locations are given in Table 4 and Figure 4. Water samples (100ml) were collected, put on ice and transferred to the CCRWQCB as described above. The complete set of MPN counts from the watershed sampling sites are presented in Appendix C. These data were collected as part of a larger effort to provide the CCRWQCB with addition data for their upcoming Total Maximum Daily Load (TMDL) report for pathogens in Morro Bay.

Table 4. List of sites where samples were taken for MPN analysis of total and fecal coliform in the Morro Bay watershed (Figure 4).

Watershed Sampling Sites
T-pier H
Shasta A
State Park D
Chorro Creek (TWB)
Los Osos Creek (SYB)
Chorro at Canet Road (CAN)
San Luisito Creek (SLU)
San Bernardo Creek (SBE)
Warden Creek (WAR)
Clark Canyon Creek (LVR)
Los Osos Creek (SYB)
3rd Street Dock Seep
Pismo Seep
Sweet Springs
Pasadena U
Baywood Pier S
Cuesta Inlet Doris and Binscarth
Upper Groundwater Well 3rd Street
Lower Groundwater Well 8th Street
Standpipe at 2nd and El Moro
T-pier H
Shasta A

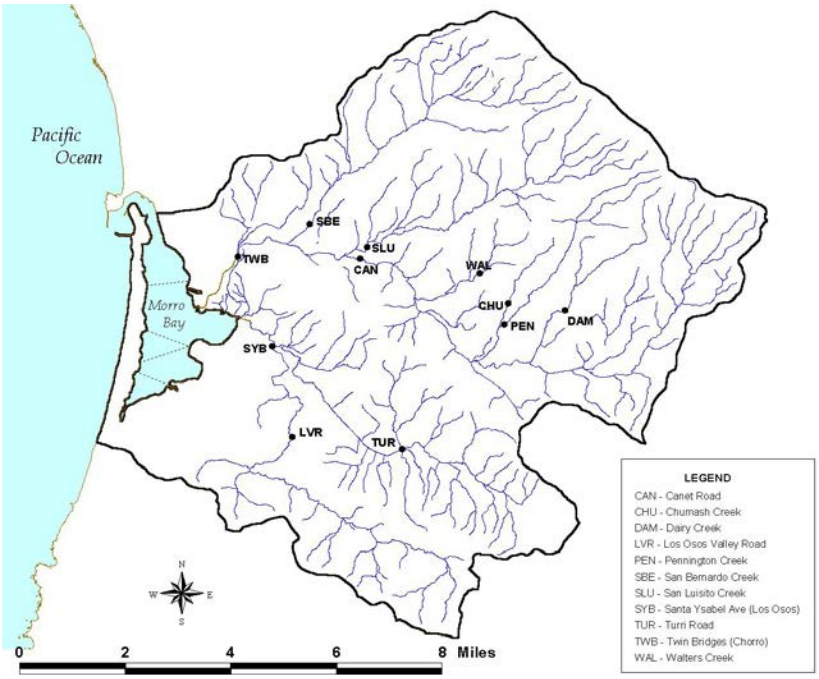

Figure 4. Map of Morro Bay watershed with the approximate positions of the sampling sites marked as per Table 4.

Lease area 13 grid sampling

On February 27, 2001, the MBSTAC decided to conduct a third "dry season sampling" referred to here as the "grid at 13" sampling. The focus of this study was to characterize the "Prohibited" portion of lease M-614-01, Parcel 1, which has been closed year-round. DHS established fifteen sampling stations around Parcel 1 in a "grid" format. Unlike the other sampling stations in this study that had physical markers for location, these stations were identified using a GPS and the coordinates listed in Table 5. Locations included the eelgrass-covered areas as well as both the channel and mud flats (Figure 5). Water was collected (100ml) at each of these sampling stations for twenty-five (25) days randomly selected between June 1 and October 1, 2001. Twenty of these sampling days coincided with the seep sampling events (see above). Samples were tested for fecal coliform by the MPN method. This grid sampling was designed to help DHS better characterize the growing area and possibly allow a portion of the lease area to reopen if the data was supportive. The susceptibility of the mudflats and/or the channel to higher levels of fecal coliform counts was evaluated as part of this effort.

Table 5. List of sites where samples were taken for MPN analysis of total and fecal coliform in the grid at Parcel 1 (Figure 5).

Sampling Sites	Lon. (N)	Lat (W)
Bay Site 12	35.20.33	120.50.90
Bay Site 13	35.20.74	120.50.99
Bay Site 13A	35.20.86	120.51.03
Bay Site 50	35.20.53	120.51.47
Bay Site 51	35.20.48	120.51.31
Bay Site 52	35.20.46	120.51.14
Bay Site 53	35.20.49	120.50.99
Bay Site 54	35.20.64	120.51.31
Bay Site 55	35.20.64	120.51.20
Bay Site 56	35.20.64	120.51.09
Bay Site 57	35.20.81	120.51.28
Bay Site 58	35.20.76	120.51.19
Bay Site 59	35.20.70	120.51.10
Bay Site 60	35.20.90	120.51.26
Bay Site 61	35.20.90	120.51.17

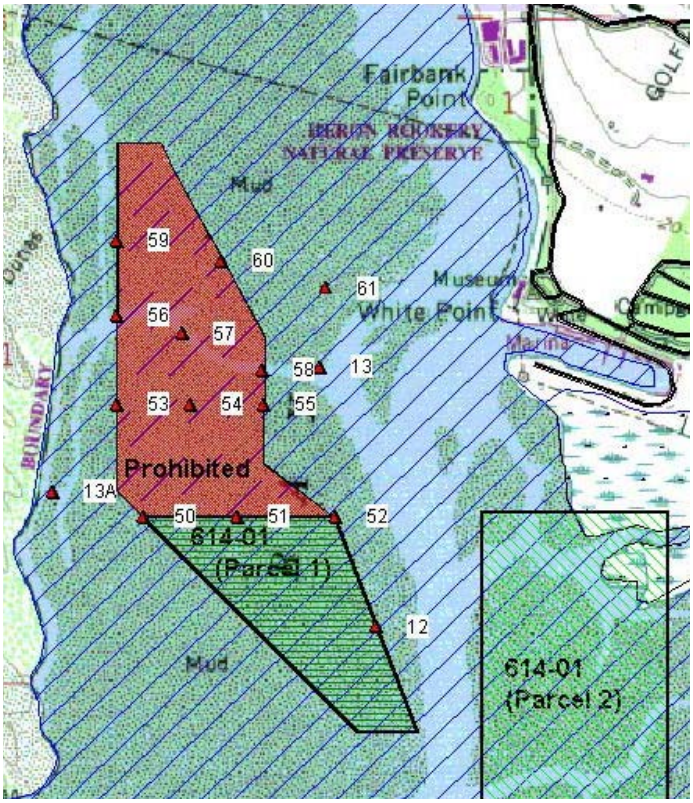

Figure 5. Map of Morro Bay with oyster lease M-614-01, Parcel 1. The approximate position of the "grid at 13" sampling sites are marked as per Table 5.

Quality Assurance and Quality Control (QA/QC) Measures

To address QA/QC issues that were brought up during the design phase of the study, a set of four experiments were initiated.

Water Quality (Total and Fecal Coliform) QA/QC

Because the total and fecal coliform counts were performed at four different certified laboratories, an inter-lab calibration study was conducted to ensure that all four labs were returning comparable data. BioVir Laboratories prepared four 1 liter bay water samples that had been spiked with differing amounts of sewage sludge. The samples were aliquoted into 100 ml jars and sent to each of the four California Department of Health Services certified laboratories involved in the study (although only BioVir and SLOCH labs were certified for shellfish). The MPN total and fecal coliform counts that were returned are summarized in Figure 6. All four labs returned results that were statistically indistinguishable. Differences between the lab results were within the 95% confidence limit for any one measurement.

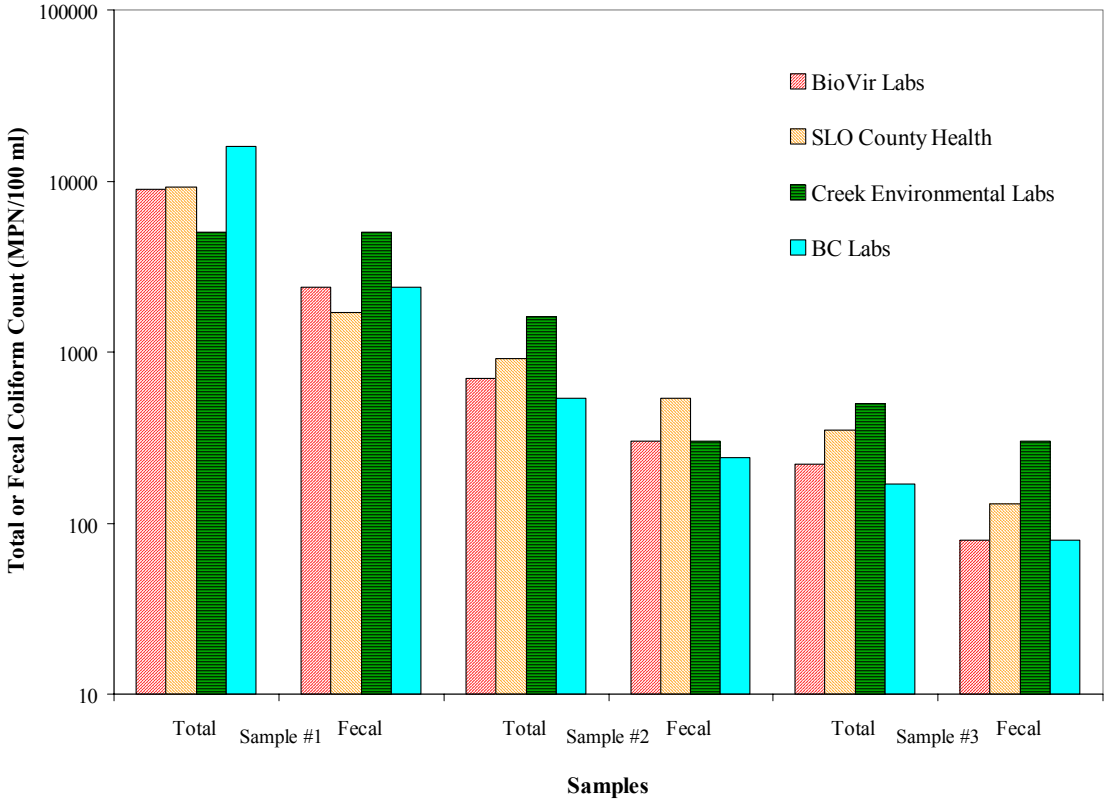

Figure 6. Comparison of Total and Fecal Coliform counts from the four certified laboratories using the MPN method on the same three samples.

Comparison of Membrane Filtration and MPN

Another QA/QC issue was brought out by the necessity of using the membrane filtration (MF) method for isolating fecal coliforms for ribotyping. The California Department of Health Services (overseeing the oyster harvesting operation) is limited to using fecal coliform numbers gathered using the MPN method. This sub-study was undertaken to determine the relationship between counts collected using the MPN method and counts obtained with the MF method. Since the sites chosen for study in the bay had samples collected using both methods we were able to compare the results (Figure 7). Regression analysis showed a statistically significant relationship between the two methods.

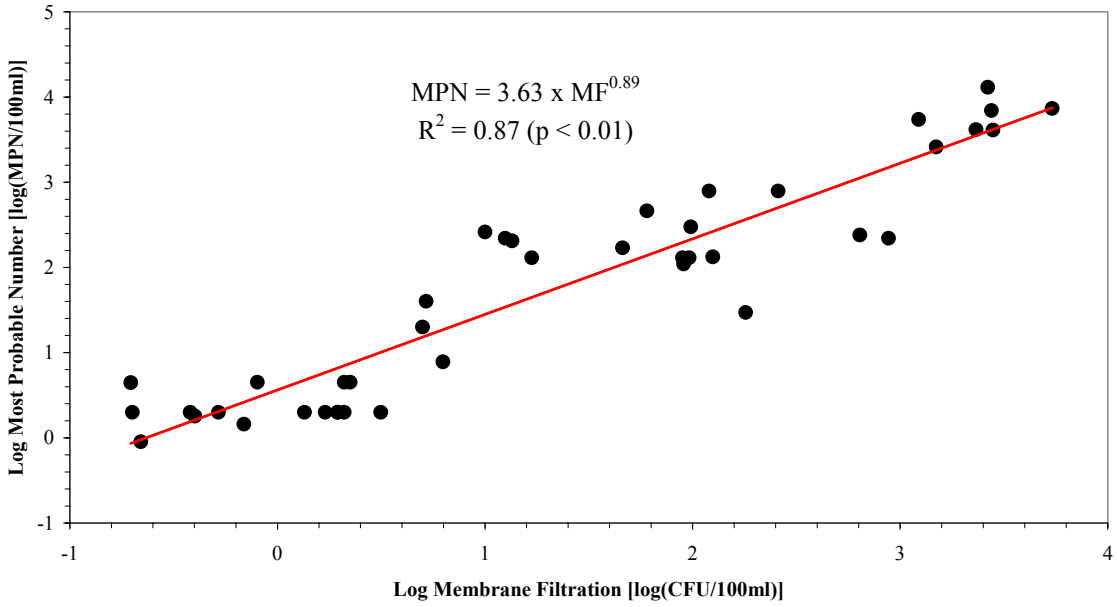

Figure 7. Comparison of Membrane Filtration and MPN methods for estimating fecal coliform counts.

Genetic Fingerprinting QA/QC - Ribotyping Reproducibility

The question of reproducibility for the ribotyping method had not been addressed in the scientific literature at the time this study was initiated. Therefore, a double-blind sub-study was performed to address reproducibility for the ribotyping method. This sub-study examined how often the same strain of *E. coli* would produce the same exact ribotype pattern. Cal Poly isolated and confirmed as *E. coli* (using API20E strips) forty strains from known fecal sources. Triplicate cultures of each strain were collected and then labeled with random numbers before they were sent to UW for ribotyping. These were added to the source sample library after completion of the double-blind study and were in addition to Cal Poly's initial library source sampling effort. At UW the ribotypes of all 120 strains were compared and placed into exact match groups. Cal Poly was sent this information to compare to the original strain designations. As Table 6 shows, all triplicate ribotypes matched without exception. Some of the strains from the same source gave the same ribotypes. This implies that the same strain of *E. coli* was present in both fecal samples which is expected for animals in the same species.

Table 6. QA/QC for Ribotype reproducibility.

Ribotype Number	Number of Strains	Source of Feces	Strain Number of Known *E. coli* from Cal Poly
1	3	Seal	1496
2	3	Gull	52
3	3	Bovine	21
4	3	Gull	25
5	15	Sea Lion	13, 24, 31, 34, 65
6	3	Bovine	13
7	3	Gull	43
8	9	Bovine	32, 33, 34
9	3	Human	9764
10	3	Horse	1723
11	3	Cat	8711
12	3	Human	1507
13	3	Human	9763
14	21	Sea Lion	42, 45, 52, 54, 55, 61, 64
15	3	Human	8715
16	3	Gull	11
17	3	Human	9761
18	6	Gull	12, 15
19	3	Bovine	53
20	3	Human	1464
21	3	Gull	14
22	3	Bovine	41
23	3	Bovine	25
24	3	Bovine	22
25	3	Sea Lion	9760
26	3	Gull	42
27	3	Horse	9755
	120		

Genetic Fingerprinting QA/QC - Strain Isolation Frequency

The last QA/QC question was related to sampling frequency and the isolation of *E. coli* strains for ribotyping. Dr. Samadpour's protocol for ribotyping called for the isolation of three to five strains of fecal coliform bacteria from each environmental sample that were then confirmed as *E. coli*. If any strain turned out to be some other kind of fecal coliform bacterium, *Klebsiella pneumoniae* for example, it was discarded. Thus anywhere from zero to five strains of *E. coli* were isolated from a single environmental sample. If more strains could be isolated from a single sample then fewer samples would need to be collected, making future studies somewhat cheaper. However, if bacteria are not evenly distributed in the environment, collecting too many strains from a single sample could easily bias the results. A relevant example might be a sample

of bay water that included a chunk of feces. During transit to the laboratory the chunk could break apart and that sample would have a much higher number of *E. coli* with same ribotype than was present in the rest of the bay.

The original sub-study design was to collect ten strains from single samples and compare the distribution of ribotypes to when only 1 strain per sample was isolated from the same environment. This was to be done with bay water, sediment and oyster samples. Unfortunately, it was not possible to consistently collect 10 strains from a single sample and attempts resulted in at most 5 to 6 *E. coli* strains being isolated from the designated samples. Four samples with 16 strains each were collected in a final attempt to isolate larger numbers of strains from a single sample. The correct method for validating the assumption that multiple strains from a single sample are independent and would not bias results requires the comparison of a single sample with multiple strains against the same number of strains gathered as one strain per sample. The ribotype distributions under these strategies should then be compared using a simple Chi-squared Test of Independence or Fisher's Exact Test. If a significant difference between these two strategies is found, then one must rely solely on the single strain per sample data set. If no difference is found, however, there is evidence that the multiple strains per sample data set would be acceptable. Unfortunately, because only a small number of strains (16) were ever isolated from a single filter, both the Chi-squared and Fisher tests would possess very low power. In fact, because the number of ribotypes seen in the study was quite large (674) it is now clear that even 16 strains per sample would not address this question. More than 100 strains must be isolated from a single sample before the method has sufficient power for the results to be convincing. This approach would be prohibitively expensive so another method was sought to address this problem.

In the interests of presenting a statistically conservative analysis, a new data set was constructed such that in cases where multiple strains were collected from a single sample, only the first strain from that sample was used (singleton data set). In some cases there was only one strain isolated from a sample and so this resulted in no loss of data. In the worst case 16 strains were isolated from a single sample, resulting in the loss of 15 strains from the data set. The singleton data set thus contained 579 strains instead of the original 1659.

To assess the impact of using the complete data to represent the ribotype distributions rather than the singleton data, each ribotype's relative frequency was computed with both data sets. For each ribotype that was represented in both samples, the difference in relative frequency was computed. Ribotypes that only appeared in the complete data set but not in the singleton data were conservatively discarded, as their appearance may be an artifact of increased sampling effort and thus may indicate that the two distributions differ when in fact they do not. Because the data is highly non-normal, a sign test was used to analyze the differences. A significant difference in ribotype representation was found between the two strategies ($p < 0.0001$). Thus the complete data set probably has dependent (or otherwise non-representative) data.

The above analysis was repeated for a different set of singletons: the last strain from each sample as opposed to the first. A significant difference was again found between the methods ($p < 0.001$). To verify that this method of comparing the distributions is unbiased and does not tend to yield false positive results, the first and last singleton data were compared with each other.

This test did not find a significant difference between these two distributions ($p = 0.3059$). Thus, it appears that this method is both robust at detecting differences in the distributions, and that our choice to use the first strain from the samples introduced no bias in the results. From this analysis it appears that future studies should only collect the ribotype of a single *E. coli* from each sample taken.

Statistical comparisons of ribotype distributions

The ribotype distributions at each site and time were compared using loglinear models (Agresti, 1990). All modeling began with a saturated model to express the multiway table representing the distribution of samples across ribotype groups (e.g., bird, livestock, domestic, human, wild, unknown, etc), sampling locations (e.g., Bay 11B, Bay 12, Bay 13, Chorro Creek, etc.), and sampling season (e.g., wet or dry). When necessary, in cases where there was no significant evidence that the data differed across ribotype groups, sampling locations, or seasons, data was pooled to provide numerical stability of the estimates and/or as an aid to model interpretation. In cases where the cells of the multiway table were empty and groups (or locations or seasons) could not be meaningfully combined, the data was analyzed by first adding 0.5 to all tabled values to ensure numerical stability (i.e., to avoid computing the logarithm of zero) (Agresti, 1990). Chi-square tests were used to assess whether or not differences existed in the ribotype distributions across season and site. Sites were compared among each other by examining the model coefficients and statistical significance was assessed using Wald tests. The loglinear model requires that the observations are a random sample from a multinomial distribution and therefore are independent. In this context, it is required for a given site and time, that the strains analyzed are independent so that conditions do not exist where the presence of a certain ribotype in the sample alters the probability of observing another ribotype from the underlying distribution. In other words, if you take more than one strain per sample there is a clear chance that you will bias results. Thus the results presented in the report are based on the singleton data that included only one strain per sample. The results of statistical analysis with the complete data set are presented in Appendix F.

RESULTS & DISCUSSION

Fecal Coliform counts (MPN)

Fecal coliform counts in the bay sampling sites were consistently less than counts in Los Osos and Chorro Creeks (Figure 8). During the wet sampling, the fecal coliform counts were about two orders of magnitude higher on average than the samples take during the dry season (Figure 8). During the wet sampling, there was a large increase in the fecal coliform MPN the day of the event, however the high levels decreased one day after a rain event. There were no significant differences between the samples taken on the reopening day for the oyster growing areas and those taken during the dry sampling events (ANOVA, $p > 0.3$). Fecal coliform counts from Pismo and 3rd St. Dock seeps were consistently above the recreational contact standard, independent of season (Figure 9). Fecal Coliform counts in the oysters and sediment varied inconsistently during rain events although counts were consistently higher for wet compared to dry sampling times. The complete set of MPN fecal coliform counts are provided in Appendix B.

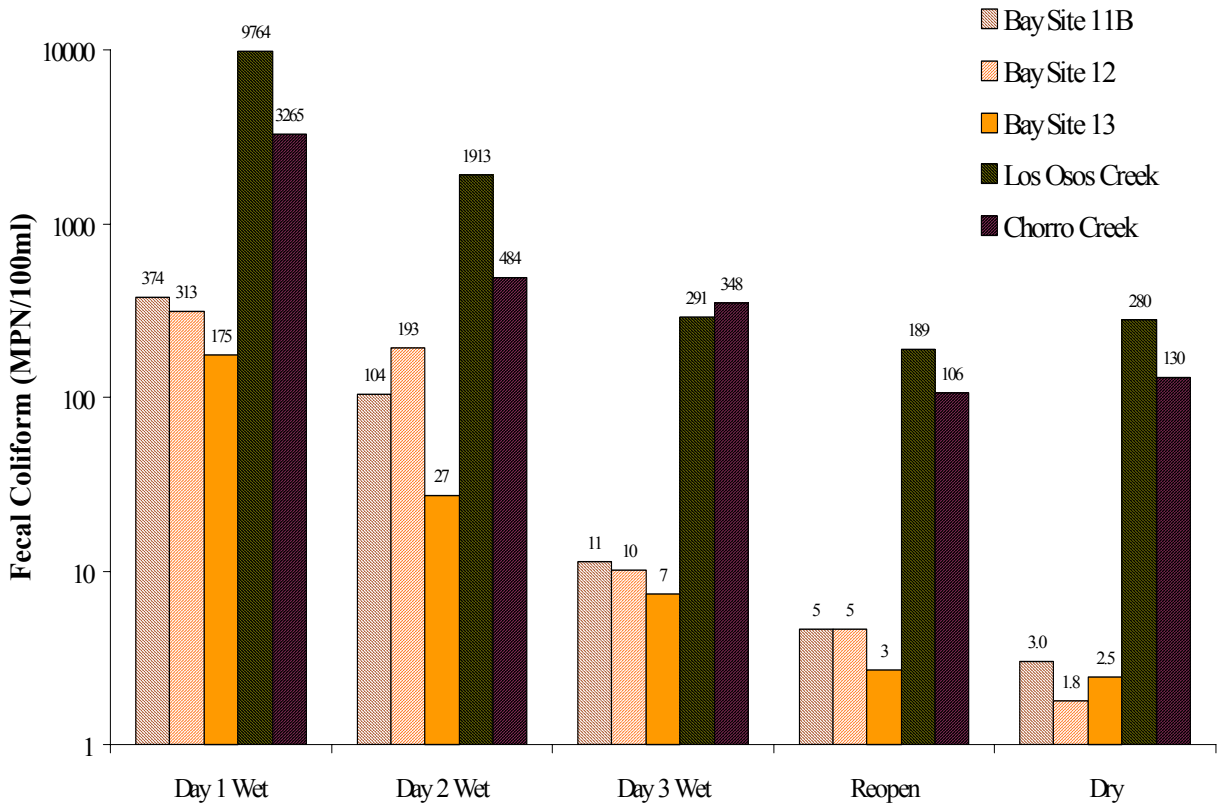

Figure 8. Geometric mean of MPN counts of fecal coliforms at the DNA sites in Morro Bay, Los Osos and Chorro creeks during the course of the study.

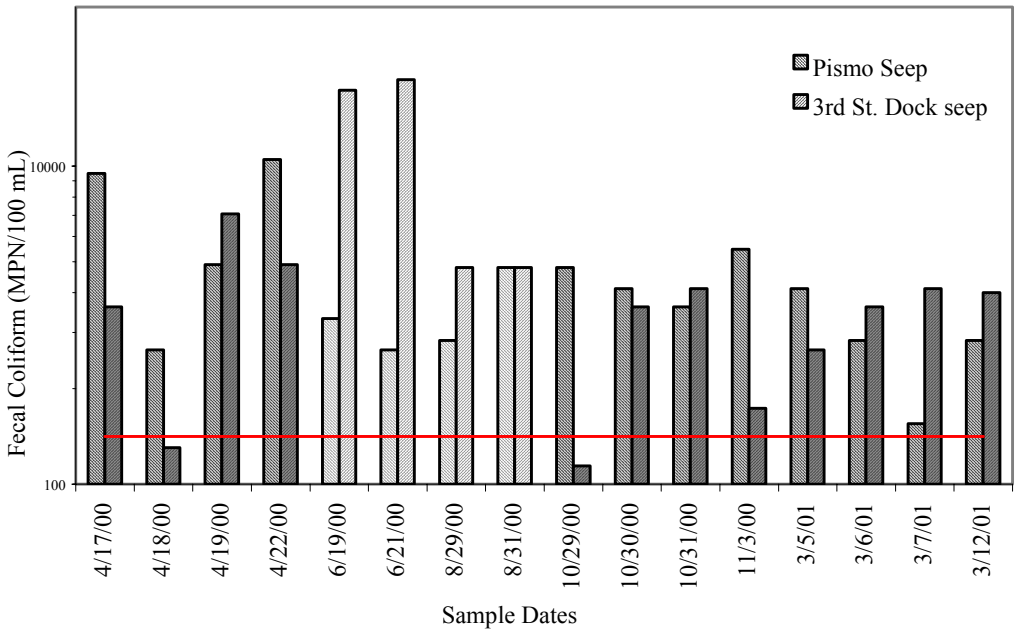

Figure 9. MPN counts of fecal coliforms at the seeps during the course of the study. Dark bars were from samples taken during wet events and light bars from dry events. The line indicates the recreational contact limit of 200 MPN/100 mL.

Loading estimates

The MPN fecal coliform counts taken from Los Osos and Chorro creeks over the course of this study combined with the flow rates from the creeks provide an estimate of the total fecal coliform load to the bay from the creeks. Flow rates in daily average cubic feet per second were obtained from John Wadell of San Luis Obispo County. Flow rates were available for the years 1993-2000 for Los Osos Creek and years 1987-2000 for Chorro Creeks. In order to remove the annual variation in rainfall and runoff between years, the flow rates used in this study for loading calculations were those taken from both creeks from 1993-2000. Flow data from these creeks were adjusted based on the location of the gauging station and the proportion of the watershed that was represented. For example, flow totals from Los Osos Creek gauging station (placed where Los Osos Valley Road crosses the creek) did not include the flows from Warden Creek and minor tributaries, which represents ~ 70% of the watershed. Therefore, measured flow totals from Los Osos Creek were increased by a factor of 3.3. A similar approach was taken for flow estimates from Chorro Creek gauging station (placed at Canet Road), although proportionally more of the watershed had available measurements (54%). Both creek's flows were estimated for the point at which samples were taken for fecal coliform counts (SYB and TWB). Watershed areas were delineated from the Tetra Tech Sediment Loading Study (1998). Daily average cubic feet per second measurements for a given month over the 1993-2000 period were converted to liters per month and the months from October to September summed to give yearly rates (Table 7). Maximum (10/97 to 9/98) and minimum (10/93 to 9/94) yearly flows were included to show interannual variation. Seep flows, estimated from a previous Tetra Tech study (1998) were presented as an average yearly flow (Table 7). For each month sampled during this study, a geomean was used to estimate fecal coliform concentrations in the creeks and groundwater. For

months where no MPN samples were taken, a linear interpolation was used to estimate the monthly concentration for each flow. The flow data was then combined with the fecal coliform concentrations to produce yearly bacterial loadings (Table 7). While Chorro Creek had consistently higher flows, the larger coliform counts in Los Osos Creek resulted in higher loading on average for Los Osos Creek. However, during the high flow year the coliform loading was greatest from Chorro Creek. Ground water coliform loading contributions were two orders of magnitude less than the creeks.

Table 7. Yearly Loading of fecal coliforms (MPN/yr) for Los Osos Creek, Chorro Creeks and groundwater (the seeps).

Flow (L/yr)	**Minimum (1993-1994)**	**Mean (1993-2000)**	**Maximum (1997-1998)**
Los Osos Creek	1.19E+09	1.57E+10	1.94E+10
Chorro Creek	2.66E+10	3.06E+10	6.19E+10
Groundwater		8.93E+08	
Load (MPN/yr)			
Los Osos Creek	1.46E+13	2.29E+14	2.45E+14
Chorro Creek	1.10E+14	1.31E+14	2.63E+14
Groundwater		2.42E+12	

Library source samples

Library source samples collected during this study are summarized in Table 8. Due to difficulties with obtaining permits for mammal tracking and trapping, there were no wild mammal sources collected from the Morro Bay watershed. The sample size for humans and domesticated dogs and cats were low due to poor community response to our voluntary mailing system. The number of domestic mammals and local bird samples were near expectations and the species of the area were well represented in the bird populations.

Table 8. Distribution of library source samples provided for ribotyping in this study.

Total Wild Mammals	**73**	**Total Humans**	**34**	**Total Domestic Mammal**	**130**	**Total Birds**	**121**
Deer	0	Los Osos or Morro Bay	32	Cow	97	Gulls	35
Raccoon	0	Waste Water Treatment Plant	2	Horse	25	Egret	4
Ground squirrels	0			Sheep	8	Pelican	0
Sea Lions	70			Dogs	6	Ducks	6
Harbor seals	3			Cats	5	Coots	25
Otters	0					Cormorants	17
Mice	0					Herons	6
Red Fox	0					Sand Pipers	4
Rabbits	0					Brandts	15
Opossum	0					Godwit	11
Total Samples = 358							

Source and strain tracking

A grand total of 1659 strains of *E. coli* were isolated from the samples collected around Morro Bay (full data set in Appendix D). A total of 29 different sources were identified as contributing *E. coli* to the sampling sites (Tables 9 and 10). To facilitate source characterization, ribotype sources were placed into six groups that each described a general category (Table 9). Fecal sources were determined for 1235 strains (74.4%), while 424 strains (25.6%) could not be matched to any strain in the UW library. The percentage of strains from unknown sources ranged from 16% (in Chorro Creek and Pismo Seep) to 54% (in sediment) at different sampling sites. When results were summed over the entire study the largest fractions of *E. coli* came from four sources: bird (22%), human (17%), bovine (14%) or dog (9%). Expressed as a percent of *E. coli* strains with known sources: bird (30%), human (23%), bovine (19%) or dog (11%). Birds were the largest source of *E. coli* in the bay waters, Los Osos Creek, 3rd St. Dock seep, sediment and oysters. Bovine sources contributed the majority of *E. coli* in Chorro Creek and humans contributed most at Pismo Seep.

Table 9. Grouping of sources of *E. coli* found in this study. Column headers (bold) are the groupings used for later analyses.

Bird	**Livestock**	**Domestic**	**Human**	**Wild**
Avian	Bovine	Canine	Human	Marine Mammal
Pigeon	Horse	Dog	WWTP Sludge	Sea Lion
Crow	Sheep	Cat-Dog		Seal
Gull	Porcine	Cat		Deer
Duck		Feline		Deer-Elk
Duck-Goose				Fox
Goose				Rabbit
				Opossum
				Raccoon
				Rat
				Rodent

Table 10. Sources of *E. coli* found at each site where samples were taken.

SITE	Total *E. coli*	Avian	Pigeon	Crow	Gull	Duck	Duck/Goose	Goose	Bovine	Horse	Sheep	Porcine	Canine	Dog	Cat/Dog	Cat	Feline	Human	WWTP Sludge	Marine Mammal	Sea Lion	Seal	Deer	Deer/Elk	Fox	Rabbit	Opossum	Raccoon	Rat	Rodent	Unknown
Bay 11b	233	40	0	1	12	2	0	2	32	8	0	0	3	13	0	0	1	51	2	3	4	2	3	0	0	0	0	2	2	3	47
%(Total at site)		17	0	<1	5	1	0	1	14	3	0	0	1	6	0	0	<1	22	1	1	2	1	1	0	0	0	0	1	1	1	20
%(Known)		22	0	1	6	1	0	1	17	4	0	0	2	7	0	0	1	27	1	2	2	1	2	0	0	0	0	1	1	2	n/a
Bay 12	203	23	0	0	13	0	1	2	30	3	0	0	6	17	0	0	3	33	0	2	4	3	2	0	1	0	2	0	0	3	55
%(Total at site)		11	0	0	6	0	<1	1	15	1	0	0	3	8	0	0	1	16	0	1	2	1	1	0	<1	0	1	0	0	1	27
%(Known)		16	0	0	9	0	1	1	20	2	0	0	4	11	0	0	2	22	0	1	3	2	1	0	1	0	1	0	0	2	n/a
Bay 13	169	31	0	0	13	0	1	2	31	6	0	0	0	14	0	4	0	19	0	2	1	2	1	1	0	1	0	1	0	3	36
%(Total at site)		18	0	0	8	0	1	1	18	4	0	0	0	8	0	2	0	11	0	1	1	1	1	1	0	1	0	1	0	2	21
%(Known)		23	0	0	10	0	1	2	23	5	0	0	0	11	0	3	0	14	0	2	1	2	1	1	0	1	0	1	0	2	n/a
Chorro Creek	301	34	0	1	8	0	0	3	93	11	2	0	10	18	5	0	6	38	0	0	0	0	8	0	0	0	5	2	0	7	50
%(Total at site)		11	0	<1	3	0	0	1	31	4	1	0	3	6	2	0	2	13	0	0	0	0	3	0	0	0	2	1	0	2	16
%(Known)		14	0	<1	3	0	0	1	37	4	1	0	4	7	2	0	2	15	0	0	0	0	3	0	0	0	2	1	0	3	n/a
Los Osos Creek	333	65	3	2	5	1	0	5	26	5	0	1	6	39	0	2	9	63	0	0	0	0	8	2	0	5	1	3	1	6	75
%(Total at site)		20	1	1	2	<1	0	2	8	2	0	<1	2	12	0	1	3	19	0	0	0	0	2	1	0	2	<1	1	<1	2	23
%(Known)		25	1	1	2	<1	0	2	10	2	0	<1	2	15	0	1	3	24	0	0	0	0	3	1	0	2	<1	1	<1	2	n/a
Oysters	91	31	0	0	3	0	0	0	11	0	0	0	1	3	0	0	1	5	0	2	0	1	0	0	0	0	0	2	0	0	31
%(Total at site)		34	0	0	3	0	0	0	12	0	0	0	1	3	0	0	1	5	0	2	0	1	0	0	0	0	0	2	0	0	34
%(Known)		52	0	0	5	0	0	0	18	0	0	0	2	5	0	0	2	8	0	3	0	2	0	0	0	0	0	3	0	0	n/a
Sediment	158	22	0	0	2	0	0	0	8	2	0	0	6	3	0	0	0	13	0	3	9	0	1	0	0	1	0	0	0	3	85
%(Total at site)		14	0	0	1	0	0	0	5	1	0	0	4	2	0	0	0	8	0	2	6	0	1	0	0	1	0	0	0	2	54
%(Known)		30	0	0	3	0	0	0	11	3	0	0	8	4	0	0	0	18	0	4	12	0	1	0	0	1	0	0	0	4	n/a
3rd St. Dock Seep	76	20	0	0	1	0	0	0	0	0	0	0	3	3	0	3	0	14	0	0	0	0	0	0	0	0	0	0	0	2	30
%(Total at site)		27	0	0	1	0	0	0	0	0	0	0	4	4	0	4	0	19	0	0	0	0	0	0	0	0	0	0	0	3	39
%(Known)		43	0	0	2	0	0	0	0	0	0	0	7	7	0	7	0	30	0	0	0	0	0	0	0	0	0	0	0	4	n/a
Pismo Seep	95	13	0	0	1	0	0	0	0	0	0	0	1	6	0	1	6	46	0	0	0	0	0	0	0	0	2	0	0	4	15
%(Total at site)		14	0	0	1	0	0	0	0	0	0	0	1	6	0	1	6	48	0	0	0	0	0	0	0	0	2	0	0	4	16
%(Known)		16	0	0	1	0	0	0	0	0	0	0	1	8	0	1	8	58	0	0	0	0	0	0	0	0	3	0	0	5	n/a
ALL SITES	1659	279	3	4	58	3	2	14	231	35	2	1	36	116	5	10	26	282	2	12	18	8	23	3	1	7	10	10	3	31	424
%(Total)		17	<1	<1	3	<1	<1	1	14	2	<1	<1	2	7	<1	1	2	17	<1	1	1	<1	1	<1	<1	<1	1	1	<1	2	26
%(Known)		23	<1	<1	5	<1	<1	1	19	3	<1	<1	3	9	<1	1	2	23	<1	1	1	1	2	<1	<1	1	1	1	<1	3	n/a

Strains from unknown sources

When conducting a source tracking study there will always be some environmental strains that do not match library strains and so no animal source can be identified for them. If these unknown origin strains are from preferentially one type of source then estimates of source contribution could be severely underestimated. An analysis of the frequency of occurrence for the *E. coli* ribotypes found in this study was conducted to address this question. To facilitate source characterization, ribotype sources were placed into six groups that each described a general category (Table 9).

Domestic, agricultural and wild animal sources, as well as human sources, all gave approximately the same distribution of observed frequency with about 30 to 40 "uniques"; that is, ribotypes that were observed only once in the study (Figure 10). Nearly 70 unique ribotypes were in the bird category; double what was seen for the other categories. This implies that there are more rare ribotypes in the bird category than in the other categories. This is not surprising since there are many species of birds that move through the Morro Bay watershed during the course of a year. Moreover, 187 unique ribotypes were in the unknown category. This implies that the unknown category covers a very broad range of host species and is not likely to skew the results of this study.

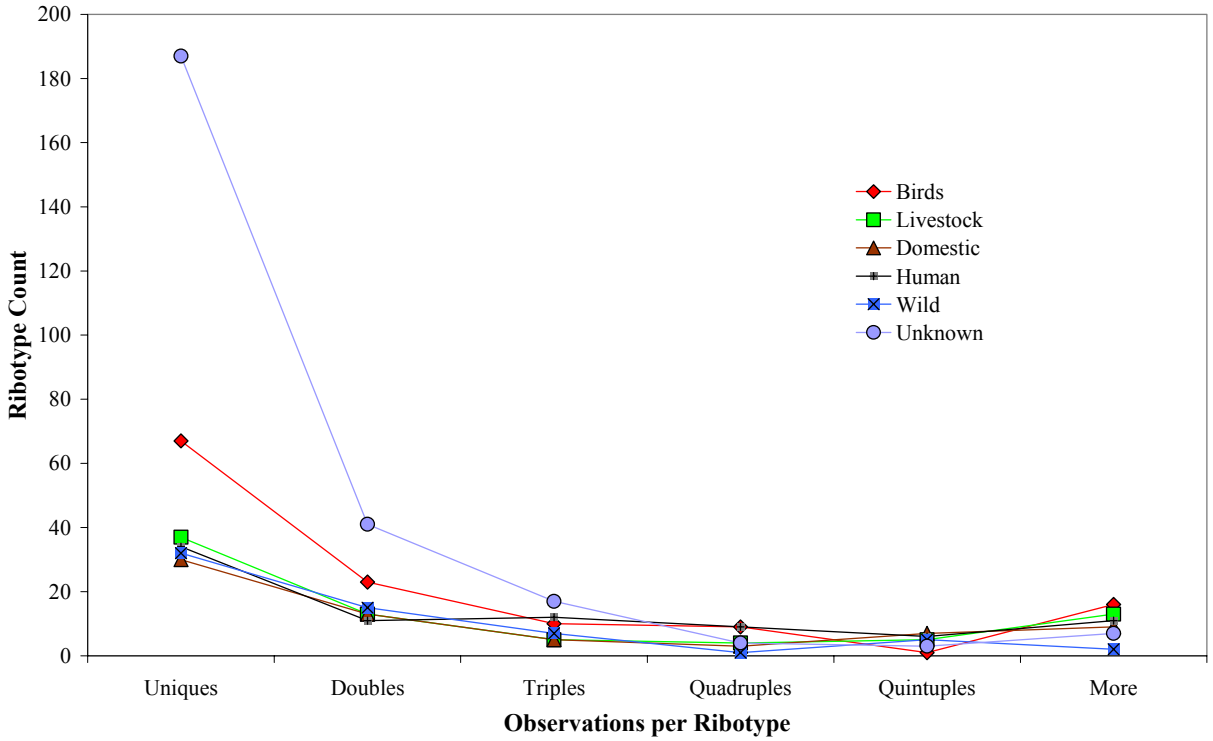

Figure 10. Line graph of the frequency of observation for ribotypes seen in the study. Ribotypes that were observed more than five times (sextuples or higher) were lumped into the "More" category. The most common ribotype was observed 33 separate times.

Tracking the distribution of specific ribotypes

Another way to look at the results of strain fingerprinting is to follow common environmental strains, as indicated by *E. coli* with the same ribotype but isolated from different sites. This type of analysis may provide insight into the pathway by which fecal contamination gets into the bay. First we analyzed the ribotypes of strains isolated from oysters (Figure 11). Any of the other sites could have been a place where *E. coli* could come from before entering the oysters so all the other sites were included in the analysis. At one extreme, ribotypes from unknown sources were 90% unique to the oysters. However, this is not surprising since Figure 11 showed that most unknown ribotypes were seen only once anyway. In addition, over 70% of the ribotypes attributed to bird sources were unique to the oysters, only five ribotypes were seen at other sites and four out of these five were seen in the bay. By contrast, all of the ribotypes from livestock sources were seen elsewhere in the study, most notably the creeks and the bay. This data is consistent with a model where birds were provided a direct pathway to oysters while livestock sources were provided a less direct route through other collection sites. A portion of the data is somewhat misleading in that no ribotypes from the seeps were found in the oysters. This does not indicate that oysters didn't pick up bacteria from the seeps. First, there was a three-month gap from the last time oysters were sampled to the first time seeps were sampled for ribotyping. In addition, the small number of *E. coli* isolated from oysters may give a false impression since ribotypes from the seeps were seen at other sites.

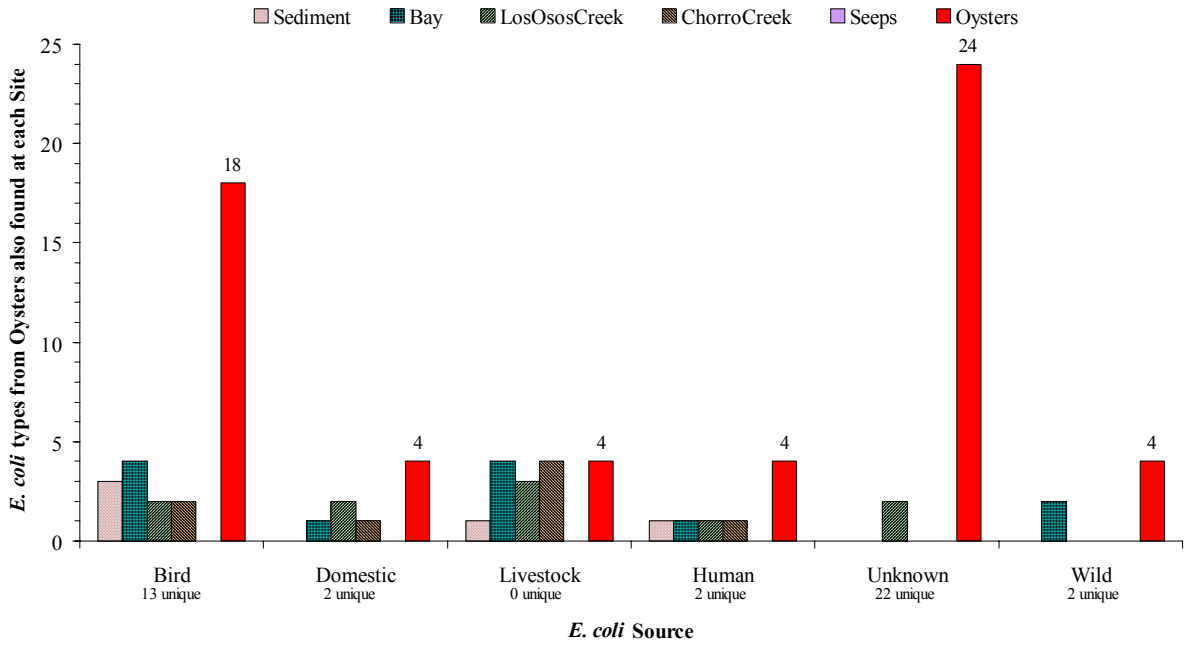

Figure 11. Tracking of ribotypes found in oysters as separated by source group. The number of ribotypes unique to oysters is listed under each source grouping.

The sediment was then analyzed in the same fashion. Since oysters cannot contribute *E. coli* ribotypes to the sediment, oysters were not included in the analysis. Unusual amounts of ribotypes from unknown sources were seen in the sediment, perhaps because of the proximity of birds and marine animals whose feces were not sampled for inclusion into the library. All but one of the ribotypes of unknown source were unique to the sediment. Six of the nine human ribotypes in the sediment were seen at other sites, including the seeps (Figure 12). Similarly, four of eight ribotypes from livestock and two of three ribotypes from domestic animals (67%) were seen in the bay and creeks. In contrast, ribotypes attributed to wild animal sources were 70% unique to the sediment; this may be due to the fact that the sediment had a high proportion of *E. coli* from marine mammal sources (Table 10). Over 60% of the ribotypes from bird sources were unique to the sediment. These data are consistent with a model where both birds and wild animals were provided with a more direct pathway for input of *E. coli* to the sediment while other sources, those with fewer ribotypes unique to the sediment, had less direct access to the sediment.

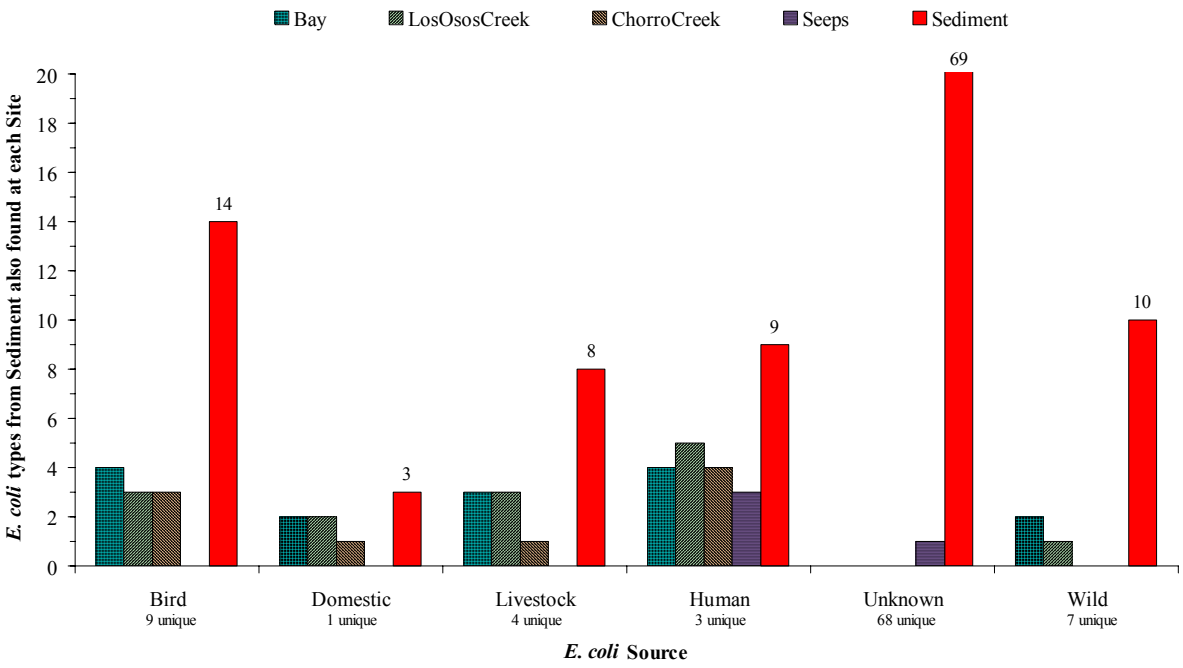

Figure 12. Tracking of ribotypes found in sediment as separated by source group. The number of ribotypes unique to sediment is listed under each source grouping.

Lastly, the bay waters were treated as a single site and ribotypes from the bay were tracked. Once again, oysters were removed from the analysis. Every site shared some ribotypes from each source of *E. coli* with the waters of the bay (Figure 13). The only exception was a lack of *E. coli* from livestock out of the seeps. This was expected because no *E. coli* from livestock were isolated at the seeps (Table 10). As with the sediment analysis, ribotypes from birds (60%) and wild animals (65%) were most often unique to the bay. Half of the ribotypes from domestic animals and more than half of the human ribotypes in the bay were not found elsewhere. In contrast, only 40% of the ribotypes from livestock sources were unique to the bay. In fact, over half of the ribotypes from livestock sources were also seen in Chorro Creek. These data are consistent with a model similar to the one described for sediment and oysters where birds and wild animals have direct access to the bay while livestock have pathways that include other sites. Human and domestic animal sources appear to have a mixture of direct and indirect pathways into the bay.

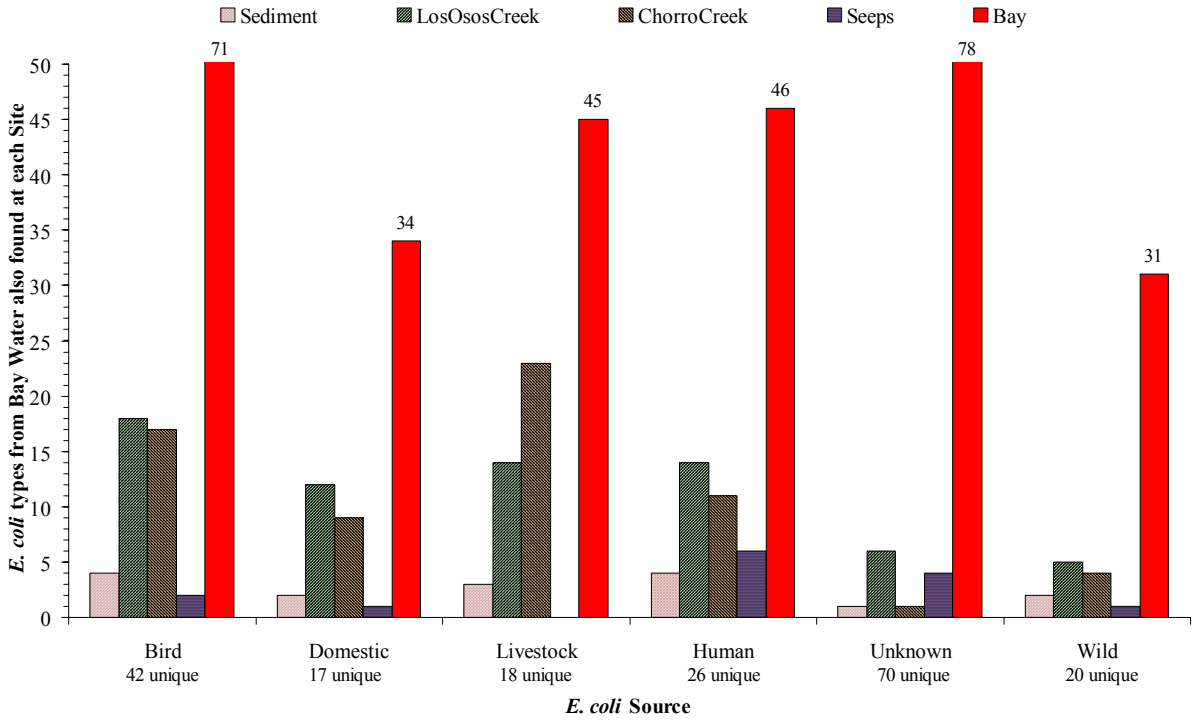

Figure 13. Tracking of ribotypes found in the Bay as separated by source group. The number of ribotypes unique to the Bay is listed under each source grouping.

It would be interesting to investigate this model by using the yearly fecal coliform loading values calculated for the creeks in the previous section of this report. Multiplying the percent source contribution from each creek by the loading of fecal coliforms would provide a model of the bay if the creeks were the only input of *E. coli*. However, the flow estimates for the creeks were not accurate enough to make such an analysis meaningful.

Statistical analysis of the distribution of E. coli sources in the Morro Bay watershed

The statistical analysis was designed to highlight which sources of *E. coli* were truly contributing to a different extent when comparing results from site to site. Sources were grouped according to the categories listed in Table 9. Because the QA/QC analysis showed that taking multiple strains from a single sample was biasing results (see above), these analyses were performed on the single sample data set. No significant differences were found between the wet and dry season for any site ($p > 0.21$). There was also no significant difference between the first wet sampling day when compared to the remaining wet sampling days ($p > 0.056$). In addition, the three bay sites were not significantly different. Thus the water sample data for the two seasons were grouped together and all three bay sites were grouped together. Sediment and oyster data were grouped in the same way. Lastly, data from Pismo and 3rd. St. Dock seeps were grouped since they lacked significant differences. Thus the final statistical analysis was performed on a data set containing six source categories and six site categories (Table 11).

Table 11. Sources of *E. coli* in the single strain data set tabulated by site and source. Numbers in parentheses are percentages of total strains from each site.

Sites \ Sources	Bird	Domestic	Livestock	Human	Wild	Unknown	Total
Oysters	11 (30%)	5 (13%)	4 (11%)	4 (11%)	1 (3%)	12 (32%)	37
Sediment	5 (13%)	2 (5%)	2 (5%)	4 (10%)	7 (17%)	20 (50%)	40
The Bay	52 (21%)	21 (9%)	50 (21%)	37 (15%)	22 (9%)	59 (25%)	241
Los Osos Creek	26 (22%)	20 (17%)	11 (9%)	20 (17%)	14 (12%)	26 (22%)	117
Chorro Creek	17 (16%)	18 (17%)	30 (28%)	14 (13%)	6 (6%)	21 (20%)	106
Seep	5 (13%)	3 (8%)	0	15 (40%)	1 (3%)	14 (37%)	38
Total	116	119	97	94	51	152	579

Because of the low number of strains collected for the oyster, sediment and seep sites some differences in source contribution that might appear large were not significant. For example, although there were no ribotypes from livestock sources present in the seeps a difference could not be validated when compared to the contribution from livestock sources in at any other site (Figure 14). Similarly, although the contribution from livestock in Chorro Creek appeared far larger, it could not be distinguished as different from the livestock contribution in the oysters. However, the contribution from human sources in the seeps was clearly larger than for the bay and Los Osos Creek. Similarly, oysters and sediment clearly had a significant difference in the contributions from bird sources.

Looking at these results on a site-by-site basis, both the sediment and the seeps had distributions of sources that were significantly different from most other sites. Conversely, the distribution of sources in the oysters could not be distinguished from the distribution in the bay waters or the creeks. Similarly, the distribution of sources in Chorro Creek could not be distinguished from the bay. This result is consistent with a model whereby the bay receives most of its *E. coli* from the creeks and the oysters collect their *E. coli* from the bay.

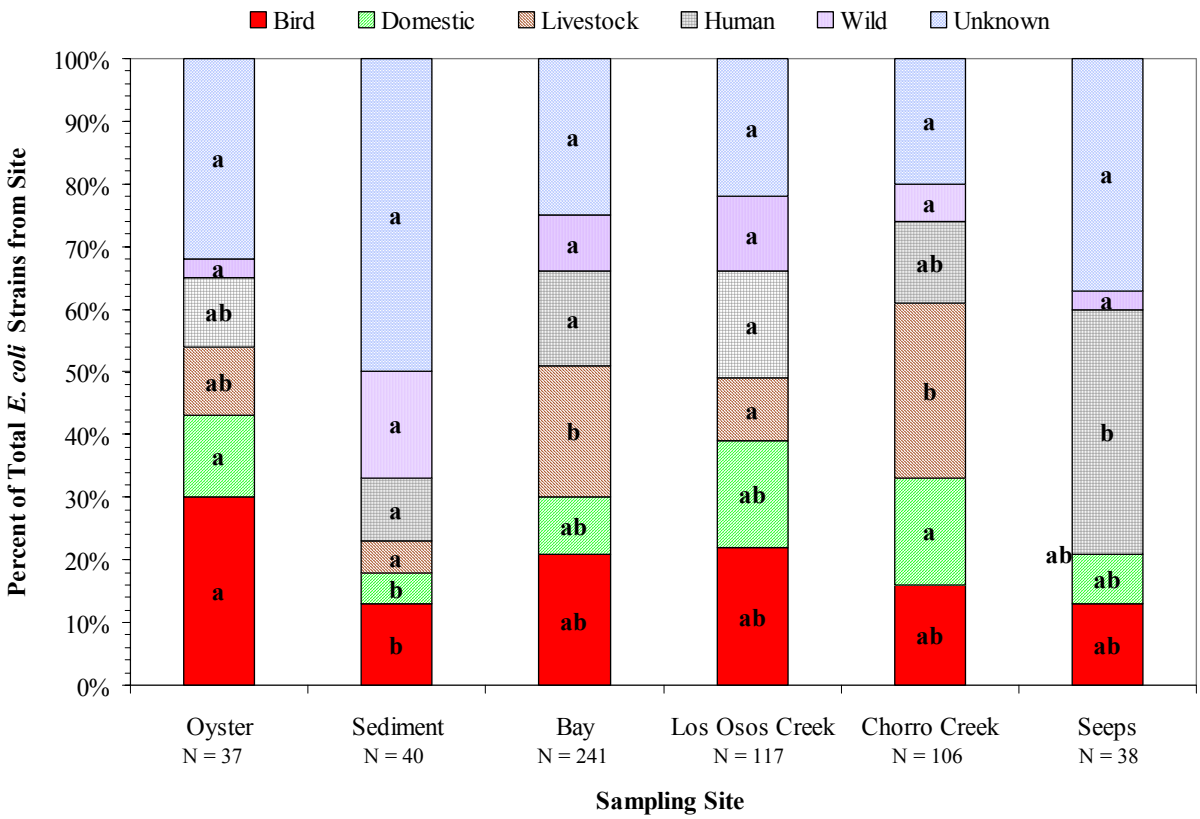

Figure 14. Percent distribution of sources for *E. coli* strains in the single strain data set as separated by site. Letters indicate sources with indistinguishable percentage contributions between sites.

Grid at 13 Sampling

The "grid at 13" sampling conducted for 25 days from June 1 through October 15, 2001 illustrated the phenomena of high counts that initiated this part of the study. When the individual stations are averaged over the sampling period, two locations of high fecal coliform are evident; one to the north of the grid and another to the south (Figure 15). Although these areas were not unique with regards to bottom type/depth, there were large clusters of floats nearby and these high counts might result from the birds roosting on these float clusters. Fecal coliform counts greater than the NSSP maximum of 43 MPN/100 mL were also observed at sites 13A, 56, 57 and 60. In particular, fecal coliform counts at site 57 exceeded regulatory levels twice (the same at site 51) although the counts were lower. When the 15 "grid" stations were averaged over each sampling day and examined as a function of time, high fecal coliform counts are centered on the month of July (Figure 16). What caused this sustained increase during this time is not known. The complete fecal coliform MPN dataset for the "grid" sampling is given the Appendix F.

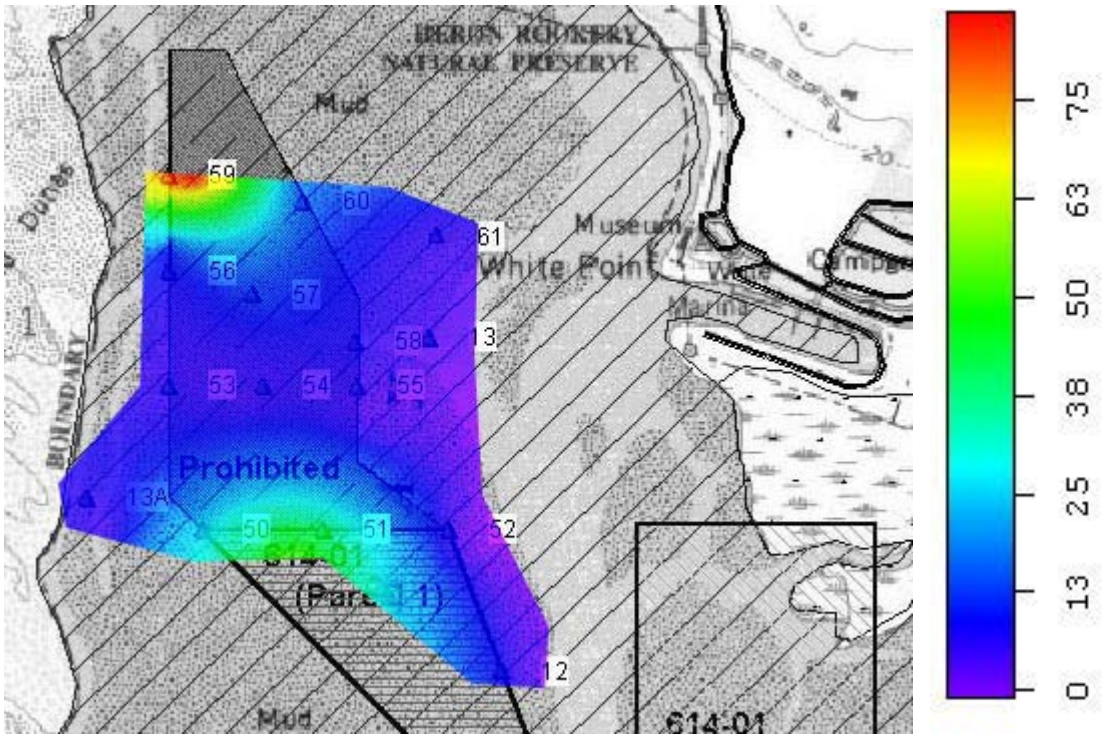

Figure 15. Contours of the average fecal coliform counts (MPN/100mL) at Lease Site 13 over the duration of the grid study.

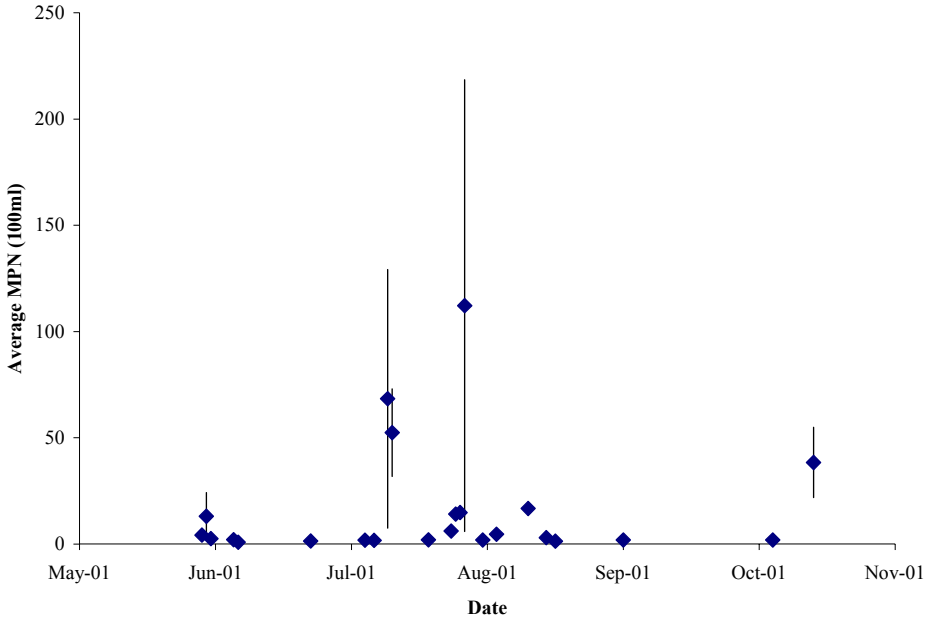

Figure 16. Average fecal coliform counts (MPN/100mL) over the entire Lease Site 13 graphed over the time of the grid study. Error bars show standard deviations.

CONCLUSIONS

Primary Objectives:

- To identify the sources of bacterial contamination which threaten the shellfish harvesting waters of the Morro Bay estuary.
    - **See Table 10 and Appendices D and E.**
- To ascertain differences in these contributions for individual sites around the bay.
    - **See Table 10 and Appendices D and E.**
- To ascertain these source contributions separately for both wet and dry seasons.
    - **No significant differences were found.**

Secondary Objectives:

- To identify the sources of bacterial contamination which threaten water-contact recreation in the Morro Bay estuary.
    - **See Table 10 and Appendices D and E.**
- To expand the database of fecal coliform strains and their fingerprints that can be used in this and later studies to identify the sources (i.e. human, cow, bird) of bacterial contamination in other regions.
    - **See Table 8.**

Overall Conclusion:

When results were summed over the entire study the largest fractions of *E. coli* came from four sources: bird (22%), human (17%), bovine (14%) or dog (9%). The four most important sources of *E. coli* in waters of Morro Bay were, bird (24%), human (17%), bovine (15%) and dog (9%). In addition, analyses presented in Figures 10 through 13 and Tables 10 and 11 provide a useful model for the flow of contaminants into the bay. Pathways for *E. coli* entering the bay are through the creeks and seeps or by more direct means, rain water run-off or direct entry for example. The model separates input into the bay by sources. A large fraction of *E. coli* from birds enters the bay through direct pathways. Conversely, most *E. coli* from livestock enters the bay through the creeks. *E. coli* from the other sources, human, and wild and domestic animals, enters the bay through all pathways somewhat equally.

LIST OF APPENDICES

Appendix A

The MF counts from samples taken for *E. coli* source tracking analysis

Appendix B

The MPN counts of fecal and total coliforms from Morro Bay sampling sites.

Appendix C

The MPN counts of fecal and total coliforms from Morro Bay watershed sampling sites.

Appendix D

The full source-matching data set of *E. coli* strains isolated from the Morro Bay samples.

Appendix E

A statistical analysis of the full source-matching data set.

Appendix F

The MPN counts of fecal and total coliforms for the "Grid at 13".

STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
895 Aerovista Place, Suite 101
San Luis Obispo, California 93401-7906

WASTE DISCHARGE/RECYCLED WATER REQUIREMENTS
ORDER NO. R3-2011-0001
Waste Discharger Identification No. 3 400910371

FOR THE
LOS OSOS WATER RECYCLING FACILITY
SAN LUIS OBISPO COUNTY

The California Regional Water Quality Control Board, Central Coast Region (hereafter Central Coast Water Board), finds that:

PURPOSE OF ORDER

1. The purpose of this Order is to prescribe new waste discharge and recycled water requirements for the County of San Luis Obispo (hereafter Discharger or County). The Discharger submitted a report of waste discharge on August 16, 2010, for authorization to discharge treated municipal wastewater from the proposed Los Osos Water Recycling Facility (LOWRF) serving approximately 12,500 residents in the community of Los Osos/Baywood Park, in San Luis Obispo County (refer to Attachment A). The purpose of the Los Osos Water Recycling Facility is to collect, treat, recycle, and dispose of domestic and municipal wastewater and subsequently eliminate discharges from on-site wastewater treatment systems in accordance with Resolution No. 83-13.

FACILITY OWNER AND LOCATION

2. The LOWRF will be owned and operated by the County of San Luis Obispo and located on a parcel of approximately 30 acres, located two miles east of the community core and behind the Los Osos cemetery, as shown on Attachment B, included as part of this Order.

   The County and the Los Osos Community Services District may mutually apply for the transfer of LOWRF responsibility after a minimum of three years. The transfer of LOWRF responsibilities must be approved by the Central Coast Water Board.

FACILITY/SITE DESCRIPTION

3. **Service Area -** Within Los Osos, the most densely zoned and developed areas are under a waste discharge prohibition issued by the Central Coast Water Board, which prohibits septic tank discharges to the groundwater basin. This area is referred to as the “Prohibition Zone.” It is the basis for the planned service area of the wastewater project and the corresponding wastewater assessment district. The current population of the planned service area is approximately 12,500, with 4,800 connections and an estimated start-up flow of

approximately 0.9 MGD. The build-out population is estimated at 18,500 with a flow of 1.2 MGD.

Monarch Grove Development – This is a development of approximately 83 residences, which discharges approximately 200,000 gallons of domestic wastewater to a wastewater treatment plant located in the Sea Pines Golf Course. The Monarch Grove Development is located within the service area, but is not currently proposed to be served by the LOWRF. However, the Monarch Grove Development may connect to the LOWRF in the future.

Bayview Heights and Martin Tracts – These areas were exempted from the prohibition zone (refer to Finding No. 27) in March 2000. These areas will not be connected to the LOWRF. However, individual residential dwellings may connect to the LOWRF in the future.

4. **Treatment -** The proposed treatment system consists of bar screens, secondary treatment (parallel oxidation ditches), secondary clarification, tertiary filtration, and ultraviolet disinfection. Solids will be thickened then mechanically dewatered and disposed of at an approved biosolids disposal site. The facility will also include a septage receiving holding tank to meter septage into the wastewater treatment process. The septage facility will receive septage only from the area served by the community wastewater treatment facility. The treatment plant's annual average flow design capacity is 1.2 million gallons per day (MGD). A diagram of the treatment processes is shown on Attachment C, included as part of this Order.

5. **Disposal and Reuse -** Treated municipal wastewater will be discharged to leachfields, urban landscape irrigation, and agricultural irrigation (refer to Attachment B). The Discharger included a list of areas proposed for disposal in its report of waste discharge application.

   - Discharge Point 1: Broderson leach field.
   - Discharge Point 2: Bayridge Estates leach field at 2 locations.
   - Discharge Point 3: Agricultural reuse irrigation at 25 different locations.
   - Discharge Point 4: Urban reuse irrigation at 10 different locations.

   Details of the Discharger's reuse program are not yet available; therefore, reclamation requirements according to California Water Code Section 13523 are included in this Order as guidance for development of that program and may be updated and/or revised to address reuse program specifics.

   In accordance with Section 13523.1 of the California Water Code, Central Coast Water Board staff will propose master reclamation permit requirements or revisions to this Order for subsequent consideration and adoption by the Water Board. Discharge Points 3 and 4 (above) will be considered in the subsequent master reclamation permit requirements.

6. **Existing Disposal Practices** – A small portion of the service area (approximately 80 homes plus a motel) is served by a tertiary treatment facility that produces fully treated and disinfected water for reuse as golf course irrigation. The remainder of the community's wastewater treatment and disposal (from approximately 5000 homes) is by septic systems. Many of these

septic systems discharge partially treated wastewater within close proximity or directly to shallow groundwater. Such practices have impaired groundwater with nitrate and impaired surface waters in Morro Bay.

Residences located outside of the service area will not be served by the LOWRF. In accordance with Section VIII.D.3.g of the Central Coast Water Quality Control Plan (Basin Plan), a wastewater management plan must be developed and implemented by a local agency. This Order requires the County to develop and implement an onsite wastewater management plan to comply with the Basin Plan and ensure water quality protection from impacts resulting from continued use of onsite disposal to the Los Osos basin.

GEOLOGY, SOILS, AND GROUNDWATER

7. **Soils and Groundwater** – The vicinity of the discharge is characterized by sandy soils overlying an upper aquifer (Old Dune Sand deposits) and a lower aquifer (Paso Robles formation). The primary disposal area is located in sandy soils on moderately sloping terrain, overlying 150 feet separation to groundwater in the Los Osos Valley Groundwater Basin. Other disposal and reuse areas are located on level to gently sloping terrain with depth to groundwater varying from 30 to 150 feet. The direction of groundwater flow is predominantly northwest toward Morro Bay; however, localized flow direction variations occur due to pumping of groundwater.

8. **Seawater intrusion** – The Los Osos Groundwater Basin has been the subject of many studies. In October 1979, the State Water Resources Control Board, Division of Planning and Research studied seawater intrusion in the Los Osos groundwater basin[1]. According to this document, the Los Osos groundwater basin was not affected by seawater intrusion at that time. Chemical analysis of chloride in both domestic and municipals wells demonstrated lower concentrations; therefore, a seawater wedge had not yet intruded into the deep portion of the aquifer. The Los Osos Wastewater Project's Final Environmental Impact Report[2] reported seawater intrusion into the Lower Aquifer (Zone D) at a rate of 60 feet per year and Lower Aquifer (Zone E) at a rate of 54 feet per year. This conclusion was based on data from 1985 through 2005 collected from wells located between Broderson Avenue and Palisades Avenue. According to the May 4, 2010 Interlocutory Stipulated Judgment (ISJ) Working Group's Los Osos Groundwater Basin Update[3], the seawater wedge has extended into the lower aquifer through "fingers" at a rate of 700 feet per year. That finding is based on data from 2005 through 2010.

   The ISJ Working group is made up of three major water purveyors in the area and San Luis Obispo County. The ISJ Working Group is currently implementing water production strategies to reduce the rate of seawater intrusion and adequately manage the Los Osos groundwater basin balance.

9. **Groundwater Quality** – The following table presents the most recent groundwater quality data available from a selection of wells screened in the uppermost aquifer in Los Osos. Well

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[1] Zipp, Richard J. *Geohydrology and Water Quality - Baywood-Los Osos Groundwater Basin, San Luis Obispo County, California*. Tech. Division of Planning and Research, State Water Resources Control Board, October 1979. Print.

[2] http://www.slocounty.ca.gov/Assets/PW/LOWWP/Draft+EIR/Appendix+D+-+Groundwater.pdf

[3] http://www.losososcsd.org/Library/Document%20Library/groundwaterbasinupdate5-4-2010[1].pdf

locations are depicted on Attachment D. Similar to historical data, the monitoring data continue to show groundwater impaired by nitrate (17 wells exceed the Maximum Contaminant Level (MCL) of 10 mg/L N for drinking water and one well is at the MCL. Four wells have concentrations approaching the MCL. Historically, shallow groundwater was the predominant source of domestic supply for Los Osos. However, due to nitrate contamination in the shallow zones, groundwater production has shifted to the better quality, deeper zones.

Table 1: Los Osos Upper Aquifer Groundwater Quality

Well ID #	Depth to Water (ft)	Nitrate as N (mg/L)	Sample Date	Well ID #	Depth to Water (ft)	Nitrate as N (mg/L)	Sample Date
7K	51.17	**11**	10/26/2006	**17F4**	na	0.6	10/26/2006
7L3	36.46	**23**	10/24/2006	**17N4**	20.75	5.6	10/25/2006
7N1	6.25	**29**	10/18/2006	**18A**	na	**11**	10/26/2006
7Q1	2.67	**21***	10/18/2006	**18B1**	17.83	7.0	10/26/2006
7R1	21.0	**13**	10/26/2006	**18C1**	16.21	**14**	10/24/2006
8N2	34.35	1.2	10/27/2006	**18E1**	24.0	7.9	11/1/2006
8Ma	39.83	4.2*	10/25/2006	**18F1**	95	5	5/8/2006
8Mb	40.17	**18***	10/25/2006	**18J6**	19.50	1.9*	10/19/2006
13F1	15	**19**	4/6/2006	**18L3**	38.58	5.9	10/20/2006
13G	39.33	**10**	10/18/2006	**18L4**	19.52	**14**	10/24/2006
13H	25.79	2.6*	10/19/2006	**18N1**	72.63	**20**	10/27/2006
13L5	21.50	**11***	10/20/2006	**18R1**	10.50	**18**	11/1/2006
13Q1	83.58	**18**	10/27/2006	**20B**	na	6.0	10/25/2006
17D	na	**17**	10/24/2006	**21D**	10.25	4.8	10/25/2006
17E9	91.50	**13**	10/31/2006	**24A**	154.2	**11**	10/31/2006

Data Source: Cleath and Associates Los Osos Nitrate Monitoring Program, October 2006
* - other form of nitrogen detected
na – Data not available at time of report preparation

10. In October 2008, Hopkins Groundwater Consultants completed a study summarizing current hydrological conditions of the Los Osos Basin as well as potential impacts of the Los Osos wastewater treatment plant discharge. This study concluded that disposal at the Broderson site would result in less than significant impacts to adjacent groundwater. More specifically, the disposal would result in lower nitrogen loading than existing septic systems discharges and would also allow for improved planning strategies to reduce seawater intrusion rates.

SURFACE WATERS

11. The Morro Bay Estuary abuts the community of Los Osos along its northern and western perimeters. Los Osos Creek meanders east of the community and discharges to Morro Bay at the northeastern tip of Los Osos. Water quality in Morro Bay is impaired by pathogens, metals and sediment.

A DNA study[4] completed on March 29, 2002, identified humans as the primary source of coliform bacteria in freshwater seeps from shallow groundwater along the estuarine edge of Los Osos. On December 13, 2002, the Central Coast Water Board adopted a pathogen Total Maximum Daily Load (TMDL) for Morro Bay, including an associated implementation plan to achieve TMDL goals. Completion of the community wastewater system in Los Osos is a vital component of the Pathogen TMDL Implementation Plan. Los Osos Creek is impaired by nutrients and priority organic pollutants. However, based on local topography and direction of groundwater flow, such impacts are likely the result of surface runoff to Los Osos Creek rather than seepage of groundwater. On December 3, 2004, the Central Coast Water Board adopted a nutrient TMDL for Los Osos Creek, Warden Creek, and Warden Lake Wetland. The TMDL became effective on March 1, 2005.

12. **Stormwater** - Federal regulations for stormwater discharges, promulgated by the U.S. Environmental Protection Agency, require specific categories of industrial activities including Publicly Owned Treatment Works (POTWs) and construction activities that disturb a total of one acre or more to obtain NPDES permits regulating the control of stormwater. The State Water Resources Control Board has adopted general NPDES permits for stormwater discharges associated with industrial facilities and stormwater discharges associated with construction activities. This Order requires the Discharger to obtain coverage under the appropriate general NPDES permits before commencing construction and before operation of the wastewater treatment facility.

    Storm water management at the LOWRF will consist of a combination of low impact development design and runoff retention. In general, impervious surfaces will be minimized. Facilities not directly contacted by wastewater, such as the administration and maintenance buildings and parking lot, will utilize vegetated swales and retention cells to filter runoff and maximize percolation. The treatment works area will be graded to a retention basin and all stormwater will be pumped to the headworks. Stormwater from surrounding areas will be directed around the treatment works.

BASIN PLAN

13. The Central Coast Water Board has adopted the *Water Quality Control Plan, Central Coast Basin* (the Basin Plan), which designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for receiving waters within the Region.

14. **Surface Water Beneficial Uses** - Present and anticipated beneficial uses of Morro Bay are included in the following table. Although this project does not include discharges to surface waters, protection of these beneficial uses is important as the discharges may have direct and indirect impacts to surface waters.

Table 2 – Surface Water Beneficial Uses

Receiving Water	Beneficial Uses

[4] Kitts, Christopher, Mark N. Moline, Andrew Schaffner, Mansour Samadpour, Katie McNeil, and Shanta Duffield. *Identifying the Source of Escherichia Coli Contamination to Shellfish Growing Areas of Morro Bay Estuary*. Tech. San Luis Obispo, 2002. Print.

The Central Coast Water Board has consulted with the State and County Health Departments regarding these reuse requirements. The State DPH has evaluated the proposed project description and these waste discharge requirements and provided comments and recommendations which have been incorporated into this Order. DPH has determined that this Order is consistent with DPH's requirements, recommendations and policies regarding use of recycled water and protection of water quality and public health. DPH has also determined that this is a disposal project, not a groundwater recharge project.

The Los Osos Water Recycling Facility is designed to meet Title 22 requirements for recycled water. This Order incorporates those requirements.

17. **Recycled Water Policy** - The Strategic Plan Update 2008-2012 for the Water Boards includes a priority to increase sustainable local water supplies available for meeting existing and future beneficial uses by 1,725,000 acre-feet per year, in excess of 2002 levels, by 2015, and ensure adequate water flows for fish and wildlife habitat. The State Water Resources Control Board (State Water Board) adopted the Recycled Water Policy (Resolution No. 2009-0011) on February 3, 2009. The Recycled Water Policy is intended to support the Strategic Plan priority to promote sustainable local water supplies. Increasing the acceptance and promoting the use of recycled water is a means towards achieving sustainable local water supplies and can result in reduction in greenhouse gases, a significant driver of climate change. The Recycled Water Policy is also intended to encourage beneficial use of, rather than solely disposal of, recycled water.

18. The Recycled Water Policy calls for the development of regional groundwater basin/sub-basin salt/nutrient management plans. The State Water Board recognizes that, pursuant to the letter from statewide water and wastewater entities dated December 19, 2008, and attached to Resolution No. 2009-0011 adopting the Policy, the local water and wastewater entities, together with local salt/nutrient contributing stakeholders, will fund locally driven and controlled, collaborative processes open to all stakeholders that will prepare salt and nutrient management plans for each basin/sub-basin in California, including compliance with CEQA and participation by Central Coast Water Board staff.

19. It is the intent of the Recycled Water Policy that salts and nutrients from all sources be managed on a basin-wide or watershed-wide basis in a manner that ensures attainment of water quality objectives and protection of beneficial uses. The appropriate way to address salt and nutrient issues is through the development of regional or sub-regional salt and nutrient management plans rather than through imposing requirements solely on individual projects. The Central Coast Water Board finds that a combination of regional management plans and individual or programmatic project requirements may be necessary to protect beneficial uses.

20. One of the primary components of the required regional salt/nutrient management plans is the development and implementation of groundwater basin/sub-basin monitoring programs. As specified in the Recycled Water Policy, salt/nutrient contributing stakeholders will be responsible for conducting, compiling, and reporting the monitoring data once the regional groundwater monitoring programs are developed.

All properties subject to the prohibition (as discussed in Finding No. 3) will be required to connect to the LOWRF. The community wastewater treatment and disposal facility will achieve compliance with the prohibition, improve water quality, and is consistent with maximum benefit to people of the state. In various locations of the community, surfacing water (groundwater mixed with wastewater from septic systems) is pumped into roadside ditches and storm drains, which then flow into Morro Bay. In areas with poor drainage the surfacing water remains ponded until it either evaporates or percolates back into the soil. The surfacing of wastewater will be reduced or cease with operation of the LOWRF.

The Monitoring and Reporting Program of this Order requires the Discharger to collect representative samples in order to ensure compliance with effluent limitations and water quality objectives of the receiving water.

MONITORING PROGRAM

23. Monitoring and Reporting Program (MRP) No. R3-2011-0001 is part of this Order. The MRP requires routine wastewater influent and effluent and receiving water (groundwater) sampling and analysis to verify compliance with this Order. Monitoring reports are required monthly and an annual report is required by January 30th of each year.

CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

24. The County of San Luis Obispo is the lead agency pursuant to the California Environmental Quality Act (CEQA) (Cal. Pub. Res. Code Section 15367). As the lead agency, the County certified a final Environmental Impact Report (EIR) on September 29, 2009, for the construction and operation of a sewage treatment and water recycling facility. The EIR did not identify any potentially significant environmental effects with respect to the adoption of these waste discharge requirements and within the jurisdiction of the Central Coast Water Board. Specifically, the EIR identifies no impacts with respect to groundwater quality and water supply (EIR Table Q.2-1, Section 5.2) and no impacts with respect to drainage and surface water quality (EIR, Table Q.2-1, Section 5.3). The EIR explained that the County would need to obtain a Clean Water Act Section 404 permit and a Clean Water Act Section 401 (Water Quality Certification) for potential adverse effects on federally protected wetlands. The Central Coast Water Board will consider water quality certification in a separate regulatory process, which is not subject to the requirements of this Order.

    The Central Coast Water Board is a responsible agency pursuant to CEQA (CEQA Guidelines Section 15096). The Central Coast Water Board has considered the EIR and makes its own conclusions in this Order on whether and how to approve the waste discharge requirements for the project. Since the EIR has not identified any potentially significant environmental effects within the Water Board's jurisdiction, the Water Board is not required to make any specific finding pursuant to CEQA Guidelines 15096. The proposed waste discharge requirements will result in improved water quality in the Los Osos Basin since they require advanced tertiary treatment that will remove nitrates, among other constituents, to concentrations below applicable water quality objectives, and because

Question from podium: okay, if this place was entirely on a sewer system, at best about 1% or less

Kitts: 1% if you're lucky. My guess would be considerably less because of all the other possible sources of ecoli. And that's not 1% of human input that's

only 1% of total fecal coliform.

Question from podium: Okay, so 1/10 of a percent is probably the ballpark of the difference. Kits nods yes to the question.

California Regional Water Quality Control Board
Central Coast Region

Linda S. Adams
Secretary for Environmental Protection

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http://www.waterboards.ca.gov/centralcoast

Arnold Schwarzenegger
Governor

January 30, 2009

Mr. Mark Hutchinson
Environmental Programs Manager
County of San Luis Obispo, Department of Public Works
County Government Center, Room 207
San Luis Obispo, CA 93408

Dear Mr. Hutchinson:

STATE CLEARING HOUSE NO. 2007121034 REVISED DRAFT ENVIRONEMENTAL IMPACT REPORT: LOS OSOS WASTEWATER PROJECT, SAN LUIS OBISPO COUNTY, CALIFORNIA

Central Coast Regional Water Quality Control Board (Central Coast Water Board) staff has reviewed the County of San Luis Obispo's (County) Draft Environmental Impact Report (DEIR) for the Los Osos Wastewater Project (LOWWP). Thank you for the opportunity to comment on your DEIR. We greatly appreciate the County staff and Board of Supervisors work on solutions for wastewater management in Los Osos. We also appreciate the efforts of citizens who have participated in these County efforts and have contributed their efforts toward a positive result.

We understand that the primary goal of the LOWWP is to construct and operate a community wastewater collection, treatment and disposal system for approximately 15,000 residents, thereby complying with the Water Board's Resolution No. 83-13 (prohibition of waste discharges from individual sewage disposal systems within Los Osos/Baywood Park Area). Eliminating discharges from onsite septic systems, as directed by the Water Board, will also help accomplish the LOWWP's second goal of alleviating groundwater contamination from nitrate that has occurred because of the use of septic systems throughout the community.

The proposed project will consist of three main components: wastewater collection; wastewater treatment, which includes biosolids processing and disposal; and effluent disposal. Central Coast Water Board staff understands that the County is examining four primary alternatives on a coequal basis, as described in Section 3.3.2. of the DEIR. The preferred LOWWP project the county selects could be any one of the four alternatives or a different combination of project components. Central Coast Water Board staff is optimistic that the flexibility to mix and match project components will greatly increase environmental quality of the final wastewater project.

The California Environmental Quality Act requires that an environmental impact report identify the environmentally superior alternative from among the range of alternatives considered. All four of the proposed projects meet the project goals and objectives. However, the County has determined that the environmentally superior alternative is Proposed Project No. 4. Proposed Project 4 consists of a facultative pond treatment plant located at the Tonini property, a gravity collection system, a main pump station located at the Mid-Town site, and spray field disposal at the Tonini property and leach field disposal at the Broderson site.

Water Board staff understands that the DEIR evaluated many potentially significant impacts. With mitigation these potential impacts will not cause additional environmental impacts. However, the DEIR identifies two unmitigatable significant impacts (i.e., agricultural resources and nonrenewable resources), but the improvements in water quality far outweigh impacts that will result for the execution of this project. Central Coast Water Board staff provides the following comments.

Long-Term Maintenance for the Wastewater Treatment Plant

The DEIR lacks a discussion of long term operations and maintenance for the proposed wastewater treatment plant. Central Coast Water Board staff recommends that the final EIR incorporate a discussion of long-term operations and maintenance of the wastewater treatment plant through a public or private agency. It is our experience that secondary or tertiary treatment facilities require a high level of oversight to maintain adequate environmental conditions for superior biological treatment. It is our strong recommendation that community wastewater facilities be owned and operated by public agencies.

Dewatering of Polluted Groundwater Encountered During Construction Activities

Appendix E of the DEIR describes dewatering activities associated with the construction and installation of the wastewater collection system. Although Appendix E discusses the need to enroll in the General National Pollutant Discharge Elimination System Permit for Discharges with Low Threat to Water Quality (Low Threat Permit or Order No. R3-2006-0063) if the County requires dewatering, the County needs to consider the eligibility requirements for such discharges. In other words, if the County encounters groundwater during the construction activities that require dewatering to continue construction, then the County will be responsible for enrolling in the Low Threat Permit or have some other mechanism available to address excess water. The Low Threat Permit requires the discharger to analyze the proposed water for pollutants prior to gaining coverage under the Low Threat Permit and permission to discharge to surface waters. The quality of water proposed for discharging is required to comply with water quality criteria listed in Attachment D of the Low Threat Permit. If these criteria are not met, then the discharge will not be eligible for enrollment under the Low Threat Permit and, therefore, the County may have to address any excess trench water through another method or alternative plan. Even if the water proposed for discharge complies with the water quality criteria in Attachment D, the County will be required to adhere to

the discharge prohibitions, effluent limitations, and monitoring and reporting requirements contained in the permit.

Pipeline Trenching Impacts Associated with the Proposed STEP/STEG Alternative

The DEIR does not describe the trenching or boring depths needed for implementation of the STEP/STEG system described in Proposed Project Alternative No. 1. Project descriptions for all project alternatives explain that pipeline trenching for collection system installation will require a 20-foot wide disturbance area, but does not explain the depth at which this disturbance will occur. Furthermore, we understand that shallower trenching may result in lesser environmental impacts (i.e., ground disturbance, dewatering, etc.). The County should expand on their environmental impact evaluations regarding trenching associated with the installation of the STEP/STEG system as described in Proposed Project Alternative No. 1. This description should discuss potential environmental impacts associated with dewatering activities as a result of deeper versus shallower trenching.

Maintenance Agreement with STEP/STEG Owners

The DEIR does not discuss a mechanism between the County and the private property owners to ensure adequate access and operations and maintenance of the STEP/STEG tanks. Section 2.4.1. of the County's DEIR evaluates two systems for wastewater collection: STEP/STEG and gravity. If a STEP/STEG collection system is chosen for the final project, the County should consider formal legal agreements between the private owners and the County to ensure longevity of the STEP/STEG tanks. Without proper operation and maintenance, the tanks may fail leading to environmental and public impacts. The County should discuss long-term operation and maintenance for the STEP/STEG tanks in the DEIR. Even though the preferred project is a gravity collection system, there are likely individual lots or neighborhoods where a STEP/STEG or other type of pumped system will be needed.

Salt Management for Proposed Disposal Areas

Salt management is important in addressing the potential impacts for salt accumulation in groundwater aquifers. The only discussion of salt management in Section 2.4 (Project Components) and Section 5.2 (Groundwater Resources – Cumulative Impacts) of the DEIR, is regarding saltwater intrusion. The DEIR does not discuss potential salt accumulation due to the continuous disposal of wastewater in a designated location, specifically, spray field irrigation at the Tonini property and at the leach field at the Broderson site. Salt buildup in upper groundwater aquifers is a common problem in the Central Coast Region due to a mixture of agricultural irrigation practices and land disposal of treated wastewater. Excessive salt build up in groundwater aquifers has the potential to render the aquifer useless for future agricultural or domestic supply water use.

Section 5.2.1. (Environmental Setting) of the DEIR states that "The areas of the basin with higher TDS concentrations in shallow groundwater have been found to correspond

roughly to some of the areas of higher NO3-N (nitrate) concentrations. This may result from brine reject from domestic water softeners or other normal salt loading from domestic water use that is subsequently discharged from septic disposal systems." This suggests that salts from the treated wastewater might be an issue; especially if these treated wastewater flows are concentrated in a specific location (i.e., Tonini property and Broderson site).

Section VIII.C.4 of the Central Coast Water Quality Control Plan (Basin Plan) discusses the need for salt management and improved salt management techniques. Some suggestions provided in Section VIII.C.4 of the Basin Plan include using wet weather storage reservoirs to dilute groundwater, improving the quality/quantity of the groundwater aquifer. Also, this section discusses the use of drainage wells which divert rainwater to salt sinks in order to increase dilution.

Although these techniques may not be required, we anticipate that salt management would be a component of wastewater operations. Water Board staff will consider incorporating requirements for salt management in our waste discharge requirements.

Designing the Leach Field at the Broderson Site

In many instances, leach field systems are constructed with inadequate design considerations, which can lead to odors or nuisance, surfacing effluent, disease transmission, and pollution of surface water or groundwater. The DEIR did not discuss the design of the leach field disposal system. This evaluation should include consideration of capacity dependant on estimated build-out, peak daily flows (including the consideration of using spray fields at the Tonini property), consideration of inflow/infiltration, development of a maintenance manual, consideration for nitrogen loading, setbacks from domestic supply wells, and other requirements. These issues and requirements must be included in the final project proposal prior to the issuance of waste discharge requirements.

Broderson Site Stormwater Capture, Disposal Rate Monitoring and Mitigation, and Increased Potential for Liquefaction

Appendix E-1, Section 5.3 of the DEIR states that "[t]he leachfields would be designed so that stormwater runoff does not leave the site. Grading would contour the earth to ensure that runoff passes into the leach trenches and infiltrates to the groundwater below." This concept is consistent with Section VIII.C.4 of the Basin Plan/Salt Management as mentioned above. However, since stormwater capture will be designed to assure that precipitation runoff will not move down slope of the site, the County needs to explain the potential impacts of increased percolation levels to the perched aquifer (e.g., liquefaction zone present in the 5 to 10 feet below ground surface) associated with the stormwater capture design.

The DEIR explains that monitoring changes in groundwater levels down gradient of the Broderson site will assure that any changes "will remain less than significant." However, the DEIR fails to present a mitigation plan describing the best methods to

respond to incremental changes in groundwater levels that would allow for continued safe use of the disposal fields relative to potential destabilizing the hillside below the Broderson site, increasing liquefaction potential or limiting the amount of unsaturated soil available for effluent treatment.

The DEIR does not to provide discussion on mitigation for disposal design for Waste Water Treatment Plant Operations should monitoring data show that changes in the groundwater levels require a decreased disposal rate for the Broderson site. The EIR states that monitoring will occur to determine if the Broderson site could safely increase the level of disposal operations. However, no discussion is presented to state how the plant operations will be conducted if the Broderson site disposal rates must be decreased due to destabilization of the hillside below the disposal site. Since the Broderson site is a critical component of all four project alternatives, and because it needs to be designed to accept disposal year-round, including during the rainy season, the County should explain how disposal operations will be affected and what potential options will be available to replace any required reduction in disposal levels at Broderson.

Water Board staff will evaluate the County's waste discharge application to ensure compliance with Basin Plan design criteria, siting criteria, disposal monitoring, and associated operations and management procedures for the proposed the Broderson site leach field system. Staff will consider incorporating requirements that are specific to the design and management of the proposed disposal system.

Effluent Quality

Please describe design/expected nitrogen concentrations in the effluent from the various treatment methods. Page 3-57 says a separate nitrogen removal process is required for Proposed Project No. 4, what is it and what are the expected monthly average and daily maximums? What is the margin of safety for meeting effluent requirements? Note that Table 2-1 should refer to Biochemical rather than Biological Oxygen Demand.

Incidental Runoff from Spray Disposal

Incidental runoff refers to runoff due to sprinkler over-spray that leaves the intended and permitted disposal area. Incidental runoff of treated wastewater to surface waters is prohibited without proper permitting. Incidental runoff may occur from over watering, pipe leaks, improper maintenance, and/or irrigation during wet weather events. Incidental runoff discharges into surface waters can lead to nuisance, surface water contamination, and impacts to aquatic life. We expect the development of long-term operations and maintenance protocols to adequately manage spray disposal activities. Central Coast Water Board staff will incorporate prohibitions for unpermitted discharges of treated wastewater to surface waters in our waste discharge requirements.

Existing Septic System Abandonment

The DEIR briefly discusses abandonment of the existing septic systems, which will be a major component of the LOWWP. According to Section 3.4.2. (Septic Tank Abandonment) of the DEIR, "the SLOC [San Luis Obispo County] Department of Planning and Building requires that the private property owners pump out abandoned septic tanks and provide a copy of the receipt for pumping to the area inspector. According to the SWRCB National Pollution [sic] Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction Activity (Water Quality Order 99-08-DWQ), removing the abandoned tanks will require preparing a Storm Water Pollution Prevention Plan (SWPPP) as described above. The County will prepare a SWPPP for the entire project, including LOWWP construction and both publicly and privately financed related actions that are required such as septic tank abandonment."

The above statement alludes to removing the existing septic systems by excavation. Water Board staff foresees potentially major environmental impacts (i.e., stormwater, groundwater, etc.) from the removal of approximately 15,000 septic systems by excavation. Although a SWPPP will be required for projects that disturb one acre or greater, the combined impacts from the removal of 15,000 septic systems might not be mitigated through the implementation of a SWPPP.

Another option for abandonment of existing septic systems might include in-place abandonment. It appears that San Luis Obispo County Ordinance Title 19.01.040 makes reference to septic tank abandonment requirements of the California Plumbing Code (Appendix K.11.b.). This code allows abandoning septic systems in-place rather than excavation. This option should be considered as it might yield less disturbance to the surrounding environment and be less of a financial burden on Los Osos residents.

We recommend that the County address potential septic system abandonment alternatives (e.g., abandon in place), potential environmental impacts of septic tank removals, and associated costs for abandonment.

Stormwater Municipal Permit

The County is currently subject to the National Pollutant Discharge Elimination System (NPDES) Phase II Municipal Stormwater Permit (General Permit). As part of its responsibility, the Central Coast Water Board must determine permittees' compliance with General Permit requirements. This includes determining whether municipalities have reduced pollutant discharges to the Maximum Extent Practicable (MEP)[1]. The MEP standard is an ever-evolving and flexible standard which balances technical feasibility, cost, effectiveness, and public acceptance. The General Permit requires permittees to prevent or minimize water quality impacts from new development and

[1] "Permittees must implement Best Management Practices (BMPs) that reduce pollutants in storm water runoff to the technology-based standard of Maximum Extent Practicable (MEP) to protect water quality." Effluent Limitations, General Permit Fact Sheet, pg. 6.

redevelopment projects[2]. The volume and velocity of storm water discharged from impervious surfaces can cause increased bank erosion and downstream sedimentation, scouring, and channel widening which significantly impact aquatic ecosystems and degrade water quality. The County Storm Water Management Programs (SWMP) is required to address how new and re-developments maintain pre-development hydrologic characteristics, such as flow patterns, surface retention, and recharge rates in order to minimize post-development runoff impacts from the LOWWP. In most cases, MEP standards are not met by conventional site layouts, construction methods, and storm water conveyance systems with "end of pipe" basins and treatment systems that do not address the changes in volume and rates of storm water runoff and urban pollutants (including thermal pollution). Low Impact Development (LID) practices meet the MEP standard and are more effective at reducing pollutants in storm water runoff at a practicable cost.

LID is an alternative site design strategy that uses natural and engineered infiltration and storage techniques to control stormwater runoff where it is generated. The objective is to disperse LID devices uniformly across a site to minimize runoff. LID serves to preserve the hydrologic and environmental functions altered by conventional stormwater management. LID methods provide temporary retention areas, increase infiltration, allow for pollutant removal and control the release of stormwater into adjacent waterways (Anne Guillette, Whole Building Design Guide). For further reference please see:

http://www.epa.gov/owow/nps/lid/

Eight Common LID Practices Include:

1. Reduced and Disconnected Impervious Surfaces
2. Native Vegetation Preservation
3. Bioretention
4. Tree Boxes to Capture and Infiltrate Street Runoff
5. Vegetated Swales, Buffers, and Strips
6. Roof Leader Flows Directed to Planter Boxes and Other Vegetated Areas
7. Permeable Pavement
8. Soil Amendments to Increase Infiltration Rates

Water Board staff considers a project that meets the following descriptions (inclusive) to be a "Low Impact Development" project:

A. Runoff Volume Control. The pre-development stormwater runoff volume is maintained by a combination of minimizing the site disturbance, and providing distributed retention BMPs. Retention BMPs are structures that retain the excess (above pre-development project volumes) runoff resulting from the development for the design storm event (2-, 10-, and 25-year, 24-hour duration storm). Note that "retention" is required, as opposed to "detention"; retention may be achieved using infiltration methods, and capture-for-use methods.

[2] "Post-Construction Storm Water Management in new Development and Redevelopment – The Permittee must: 1) Develop, implement, and enforce a program to address storm water runoff from new development and redevelopment projects...by ensuring that controls are in place that would prevent or minimize water quality impacts", General Permit, pg 11, Provision e.1.

B. Peak Runoff Rate Control. Low impact development practices maintain the pre-development peak runoff discharge rate. This is done by maintaining the pre-development time of concentration and then using retention and/or detention BMPs (e.g., rain gardens, open drainage systems, etc.) that are distributed throughout the site, to control runoff volume. If retention practices are not sufficient to control the peak runoff rate, detention practices may be added.

C. Flow Frequency Duration Control. Since low impact development emulates the pre-development hydrologic regime through both volume and peak runoff rate controls, the flow frequency and duration of post-development conditions must be identical (to the greatest extent possible) to those of pre-development conditions. Maintaining pre-development hydrologic conditions will minimize or eliminate potential impacts on downstream habitat due to erosion and sedimentation.

Permittees must, therefore, incorporate LID methodology into new and redevelopment ordinances and design standards unless permittees can demonstrate that conventional BMPs are equally effective, or that conventional BMPs would result in a substantial cost savings while still adequately protecting water quality and reducing discharge volume. In order to justify using conventional BMPs based on cost, permittees must show that the cost of low impact development would be prohibitive because the "cost would exceed any benefit to be derived." (State Water Resources Control Board Order No. WQ 2000-11.). Low Impact Development techniques must be included as mitigations in the final EIR for this project.

We welcome the opportunity to meet with County staff to discuss both wastewater and stormwater issues as the project evolves. If you have questions, please contact **David LaCaro at (805) 549-3892** or at dlacaro@waterboards.ca.gov.

Sincerely;

Roger W. Briggs
Executive Officer

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Morro Bay National Estuary Program - Status of CCMP Action Plans

April 14, 2011

Action Items	Description	Initiated	Active	Status (key on p. 5)	Partners (*see acronym list*)
Cross-Cutting Actions					
CC-1	HABITAT AQUISITION: Acquire or otherwise protect lands that contain ecologically valuable habitat or habitats that provide beneficial functions to the estuary, in order to minimize nonpoint sources of pollution entering the estuary. Such acquisitions will occur in cooperation with willing public and private landowners.	☑	☑	Ongoing	Private Landowners; LCSLO; MEGA; SWAP; TNC; TPL; CDFG; Cal Poly; SCC; CSLRCD; NRCS; CA State Parks; Caltrans
CC-2	DRAINAGE: Reduce Los Osos drainage problems by acquiring low lying parcels for use as detention and retention areas.	☑	☑	Ongoing	Private Landowners; LCSLO; MEGA; SWAP; SCC; CSLRCD; CA State Parks
CC-3	TMDLs: Develop and implement Total Maximum Daily Loads for siltation, pathogens, nutrients, metals, and priority organics.	☑	☑	Ongoing	CCRWQCB; CCAMP; CCSLRCD; SLOSEA; US EPA
CC-4	URBAN RUNOFF: Implement urban storm water Best Management Practices (BMPs) to reduce pollutants entering Morro Bay and its tributaries.	☑	☑	Ongoing	Central Coast RWQCB; Coastal San Luis RCD; City of Morro Bay; Los Osos Community Services District; SLO County
CC-5	STREAM GEOMORPHOLOGY & WATER QUALITY: Maintain, restore, and enhance stream geomorphology and water quality to provide quality habitat for steelhead.	☑	☑	Ongoing	CSLRCD; Private landowners; NRCS; CDFG; CMC; SCC; US FWS; SRF; Tri County Fish Team; SLOCSI
CC-6	VOLUNTEER MONITORING: Expand and maintain the existing Volunteer Monitoring Program (VMP).	☑	☑	Ongoing	Many community volunteers; Private Landowners; CDFG; Cal Poly; SLO County Parks; CA State Parks; SWRCB; CCRWQCB; CSLRCD
CC-7	WATERSHED CREW: Establish Watershed Crew to provide planning, labor, outreach, and mapping services throughout the watershed and across the breadth of the priority issues.	☑	☑	Ongoing	CCCorps
Sedimentation					
SED-1	Increase use of management measures for road maintenance and construction activities to reduce damage to streams and the Morro Bay estuary.	☑	☑	Ongoing	CDOT; SLO County; Camp San Luis; CMC; USFS; CCCorps
SED-2	Install new and maintain existing sediment traps in order to reduce the delivery of sediment to Morro Bay.	☑	☑	In Progress	CSLRCD; Private landowners; NRCS; CDFG; SCC
SED-3	Develop and implement a watershed fire management plan to create and maintain an uneven age class of brush.	☑		Complete	USFS; CDF; NRCS; CA State Parks; Camp San Luis; SLO County
SED-4	Supply the technical and financial assistance to landowners to implement Best Management Practices (BMPs) on their land.	☑	☑	Ongoing	CSLRCD; NRCS; Camp San Luis; CCRWQCB; CCCorps; Private landowners; USFS; CA State Parks; Farm Bureau; SRF
SED-5	Supply the technical and financial assistance to landowners to implement creek restoration projects (including re-establishing floodplains and meander patterns) in Los Osos and Chorro Creeks.	☑	☑	Ongoing	NRCS; CSLRCD; CDFG; CA State Parks; Camp San Luis; Cal Poly; SLO County; CCRWQCB; CCCorps; SCC; Farm Bureau
SED-6	Re-vegetate north sandspit areas without impacting snowy plover or least tern habitat.	☑		In Progress	CA State Parks; CDFG; USFWS; CCCorps

DRAFT

SAN LORENZO RIVER WATERSHED MANAGEMENT PLAN UPDATE

December, 2001

County of Santa Cruz
Water Resources Program
Environmental Health Services
and
Planning Department

This project has been funded in part by the United States Environmental Protection Agency Assistance Agreement No. C6999214-95-0 to the State Water Resources Control Board and by Contract No. 4-133-250-0 in the amount of $82,500.00. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency or the State Water Resources Control Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

INTRODUCTION

On December 19, 1979, the Santa Cruz County Board of Supervisors adopted the San Lorenzo River Watershed Management Plan. That plan represented a joint effort by the County and the State Resources Agency, Department of Fish and Game, under the California Protected Waterways Program. The 1979 Plan was a comprehensive watershed management plan with detailed recommendations that addressed water supply, instream flows, groundwater recharge, erosion and sedimentation, flood hazard, water quality, fishery resources, aquatic habitat, biotic resources, recreation, scenic values, and historic resources. While the County was the primary agency for implementation, the 1979 Plan included recommendations for action by most of the 35 other federal, state, and local agencies whose actions affected the Watershed.

In 1995, the County of Santa Cruz Environmental Health Service obtained funding from the State Water Resources Control Board under Section 205(j) of the federal Clean Water Act to conduct a review and update of the 1979 Plan. The review focused on water quality, with detailed investigations of erosion and sedimentation and water quality degradation in the urban areas of the lower River. This document presents the results of that work and includes a broader evaluation of water quality, water resources, and fishery issues in the San Lorenzo Watershed. Ongoing programs are described and recommendations for maintaining and expanding efforts are presented. This document presents a summary of many related efforts, with references to the supporting documents for greater detail.

Background

The San Lorenzo River Watershed is a 138 square mile area located along the Central Coast of California. The River meets the Pacific Ocean at the north end of Monterey Bay in the City of Santa Cruz, some 70 miles south of San Francisco. The Watershed is the home to some 41,000 people, with 17,174 developed parcels (not including areas within the City of Santa Cruz). Approximately 3,150 of the developed parcels are located within the City of Scotts Valley. The large remainder of the Watershed is unincorporated under county jurisdiction and includes the communities of Felton, Mt. Hermon, Ben Lomond, Brookdale, Boulder Creek, Lompico, and Zayante. All residents of the Watershed derive their water supply from surface and groundwater in the Watershed. The River directly provides 60% of the water supply for 90,000 customers served by the City of Santa Cruz. The San Lorenzo River historically supported the largest salmon and steelhead fishery south of San Francisco Bay; the fourth largest steelhead fishery in the state. Coho salmon and steelhead are now listed as threatened or endangered species.

Historically the Watershed has been used for timber harvesting, and quarrying, both of which uses continue at a diminished level today. Agriculture is limited, consisting of scattered small Christmas tree farms, orchards, nurseries, and vineyards. The tourist industry has been and continues to be important, with three state parks, scattered summer homes, and motels. The San Lorenzo River discharges into the ocean at the Santa Cruz Beach Boardwalk, one of the busiest beaches in Santa Cruz County. Summer homes were the dominant residential use in the watershed until the 1950's. After that time, summer homes were converted to year round use and the Watershed experienced a high rate of residential development, peaking at some 3,300 new units

built in the 1970's. With the exception of the City of Scotts Valley, and some small sewered communities, some 13,000 properties are served by individual onsite sewage disposal systems.

The rapid rates of development, and conversion of second homes to year round use lead to extensive degradation of the River from failing septic systems, urban runoff, excessive erosion and sedimentation, and reduced streamflow from water extraction. Since the 1970's, considerable efforts have been undertaken to address these issues through the development and implementation of numerous planning documents: the San Lorenzo River Watershed Management Plan (1979), Santa Cruz County Growth Management Plan (1980), North County Water Supply Master Plan (1984), San Lorenzo Wastewater Management Plan (1995), San Lorenzo Nitrate Management Plan (1995), and the Evaluation of Water Resources Monitoring and Management (1998). While many of these efforts have made substantial steps toward addressing the problems, the San Lorenzo River continues to be listed by the federal and state government as impaired due to sediment, nutrients, and pathogens (Section 303d list). Steelhead levels continue to be depleted, Coho salmon runs are nonexistent, and the majority of water customers served by the Watershed do not have adequate, dependable long-term supplies.

THE 1979 WATERSHED MANAGEMENT PLAN

The impacts and threats to the River of the 1960's and 1970's created an impetus for action at both the state and local level. As stated in the first sentence of the 1979 Plan: “The San Lorenzo Watershed management planning process was set in motion because the people of the Watershed and their local government perceived the need to protect the natural, social and economic values of the San Lorenzo River. The River has also received statewide recognition, for both its values and its problems.”

In 1976, the San Lorenzo River was made a part of the State Protected Waterways Program, which provided substantial funding assistance for development of a waterway management plan. From the beginning this was expanded to address the whole watershed as it was recognized that protection of the waterway required watershed protection. Extensive field studies were conducted of water quality, fishery habitat, streamflow, sediment transport, erosion sources, biotic resources, fire hazard, and recreational, scenic, and historic values. Computer models of flooding, streamflow and fish habitat were developed, along with extensive databases of water quality, population growth, development trends and septic system history. The public and other agencies were extensively involved in the development of plan recommendations, through publication of a Preliminary Report on the San Lorenzo River Watershed Planning Process (1976), the draft San Lorenzo River Watershed Management Plan, and then the final plan, which was adopted in December of 1979.

Goals of the 1979 Plan

The 1979 contained goals, policies, and recommendations to address all aspects of watershed management:

- water supply and instream flow protection,
- erosion and sedimentation,
- flood hazard,

Table 4: Water Production from the San Lorenzo River Watershed, 1977-1998

WATER USER	CONNECTIONS 1977	CONNECTIONS 1998	WATER PRODUCTION FROM THE SAN LORENZO RIVER WATERSHED: 1975-78 (dry) % of total production (acre-feet) surface	1975-78 (dry) groundwater	1975-78 (dry) total	1994-98 (wet) production (acre-feet) surface	1994-98 (wet) groundwater	1994-98 (wet) total	% of water supplied by source
City of Santa Cruz[#-] SLR only	18574	22694	(97%) 5,969		(100%) 5,969	(98%) 7,765		(100%) 7,765	
San Lorenzo River- Tait Street			2,984		(33%) 2984	4,705		(37%) 4705	
Felton Diversion			908		(10%) 908	0		0	
Loch Lomond			2,077		(23%) 2077	3,060		(24%) 3060	
North Coast Streams			*2,809*		*(31%) 2809*	*4,555*		*(36%) 4555*	
Beltz Wells				*288*	*(3%) 288*		*306*	*(2%) 306*	
San Lorenzo Valley WD	4816	5696	(60%) 745	(40%) 475	1220	(45%) 838	(55%) 1025	1863	wells 39%, Pasatiempo wells 16%
Scotts Valley WD	1420	3555		100%	600		(100%) 1949	1949	groundwater 100%
Lompico WD	470	497	(60%) 39	(40%) 26	65	(80%) 56	(20%) 14	70	streams 80%, groundwater 20%
Citizens Utilities	1260	1387	(39%) 136	(61%) 212	348	(96%) 439	(4%) 16	455	Fall Cr. 39%, springs 57%, wells 4%
Big Basin Water Co.	424	575	(100%) 325		325	(84%) 203	(16%) 39	242	Jamison Cr. 84%, groundwater 16%
Forest Lakes^	320	333	(100%) 90		90		143	143	groundwater 100%
Mt. Hermon^	460	528	(100%) 143		143		251	251	groundwater 100%
Mutual Water Companies (5-199 connections)*	1844	2239	(62%) 322	(38%) 198	520	(16%) 150	(84%) 790	940	streams 16%, groundwater 84%
Individuals (1-4 connections served)*	2000	2700	(30%) 318	(70%) 742	1060	(15%) 170	(85%) 964	1134	85% groundwater, 15% springs and stream diversions (Estimated)
Silicon Valley Group (formerly Watkins-Johnson)		n/a	n/a	n/a	n/a		144	144	groundwater 100%
Hanson Quarry		n/a	n/a	n/a	n/a		276	276	groundwater 100%
TOTAL	**31,588**	**40,204**	**(76%) 8,067**	**(24%) 2,541**	**10,608**	**(62%) 9,621**	**(38%) 5917**	**15,538**	

note[#]: City of Santa Cruz totals are for its SLR sources only. North Coast streams and Beltz wells are highlighted.

note^: No water production data for Forest Lakes and Mt. Hermon was available for 1975-78; the values of 70 and 143 are estimates.

note*: County records for individual water connections are incomplete. Estimated connections are between 2300 and 3000. Estimated water useage for "Mutual Water Companies" and "Individuals" was computed by multiplying the number of connections by an average water use per connection of .42 af./year.

During 1986, nitrate levels in the San Lorenzo Valley Water District wells in the Quail Hollow area rose dramatically, threatening the safety of that supply. However, the levels stabilized and declined before they approached the safe drinking water standard of 10 mg-N/L. Nitrate did reach levels exceeding drinking water standards in municipal wells in southern Scotts Valley in 1981. As a result, that area was sewered in 1986, and nitrate levels dropped to 5 mg-N/l by 1990. Presence of toxic compounds in groundwater in the Scotts Valley area has limited the use of some wells, required expensive treatment for others, and limits the potential for augmenting groundwater storage in the contaminated aquifers.

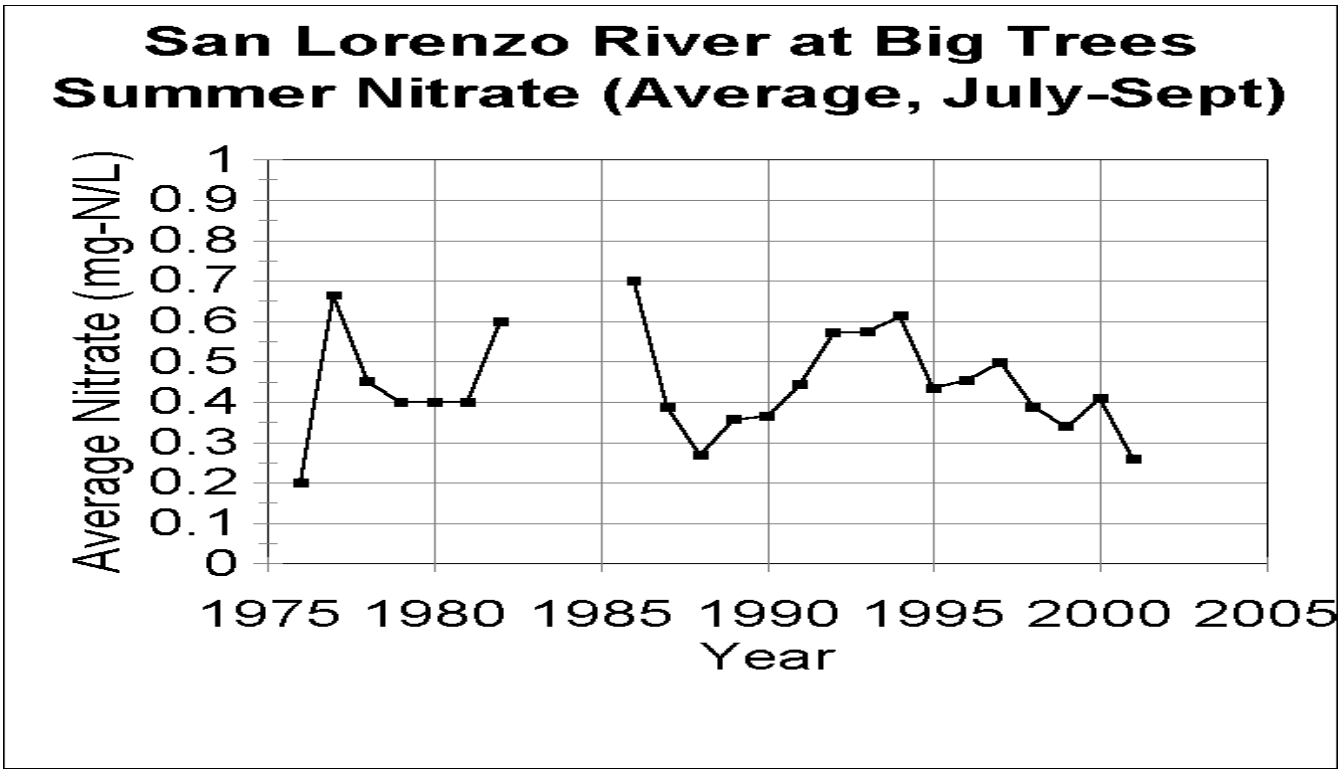
Recreation

The River and some of its tributaries are extensively utilized for swimming, wading, and non-body contact recreation throughout much of its length. The lower River lagoon divides Santa Cruz Main Beach and Seabright (Castle) Beach and influences the quality of the ocean swimming beaches in the immediate vicinity of the Rivermouth. These beaches both have substantially more than 50,000 visitors annually. Although limited occurrence of illness has been documented, indicator bacteria levels substantially exceed standards during storm periods, and the lower River lagoon is always posted as unsafe for swimming due to high bacteria levels. The River has numerous public swimming areas in Henry Cowell State Park, Ben Lomond, Boulder Creek, San Lorenzo Woods, and other areas. At times during the summer, swimming holes in the upper River have been posted as unsafe due to high fecal coliform bacteria levels. Excessive algae growth from elevated nitrate and presence of litter can also degrade the recreational experience.

Aquatic Habitat and Fisheries

Aquatic habitats can be degraded by elevated persistent turbidity, high temperatures, low dissolved oxygen, or toxic compounds. Extensive monitoring in the San Lorenzo River has consistently shown that elevated nitrate and toxic compounds do not appear to have any significant impact on fish or aquatic life in the San Lorenzo River Watershed, with the possible exception of Carbonera Creek, where assemblages of benthic invertebrates differ from those of other watershed streams suggesting possible impacts of nonspecific pollution. Dissolved oxygen levels and temperatures are generally within safe limits for cold water habitat, although temperatures can reach levels that may require higher levels of feeding in the middle portions of the River. In the lower lagoon area, dissolved oxygen and temperatures may reach levels unsuitable to salmonids, particularly when a salt-water layer forms at the bottom of the lagoon. Excessive sedimentation has a significant adverse impact on aquatic life throughout most of the Watershed.

Figure 4: Nitrate Trends in the San Lorenzo River at Big Trees



Pathogens

Presence of bacteria, virus, giardia, cryptosporidium, and other pathogens can make the water unsafe for swimming and require more expensive treatment efforts for drinking water supply. Practically all of the testing for pathogens involves testing for indicator bacteria (total coliform, fecal coliform, E. coli, and enterococcus) that would suggest the possible presence of pathogens from sewage, fecal contamination, or other contamination. Limited testing for pathogens by the City of Santa Cruz has confirmed the presence of cryptosporidium and giardia in the San Lorenzo River. The presence of indicator bacteria, while not necessarily causing illness, causes beaches to be posted with warning signs and significantly impacts recreational opportunity. The frequency of posting of swimming areas in the watershed has declined significantly since the 1970's and the 1980's, as septic systems have been upgraded and better maintained. However, the Rivermouth continues to have consistently high bacteria levels and is permanently posted as unsafe for swimming. Sources of pathogens and indicator bacteria are non-point source urban runoff, failing septic systems, sewer system leaks, pet waste, livestock, encampments, and waterfowl.

There are over 13,000 septic systems in the San Lorenzo Watershed upstream from Santa Cruz. Under current wastewater management programs, the occurrence of septic system failures is relatively low. Since 1986, the wintertime septic failure rate has declined from 5-14% to 1-3%, depending on the area (SCCHSA, 2000). However, during rainfall periods, partially treated sewage

which comes to the ground surface from septic failures can be readily washed into ditches, roadways, creeks and then the River. For brief periods after storms and in the early spring when water tables are high, ditches may continue to run, conveying diluted sewage to creeks. During dry periods, sewage from failing septic systems would not reach a waterway unless the failure was right on the banks of the creek. Programs implemented since 1986 have required system upgrades, improved setbacks from creeks and early identification of failures. Summer bacteria levels have shown substantial improvement, and the River generally meets standards for safe swimming at all areas upstream from Santa Cruz. Subsurface contribution of bacteria from apparently functioning septic systems has not been found to occur in the San Lorenzo Watershed (SCCHSA, 1989). Dry season bacteria in the upstream areas are most likely from nonspecific urban sources. The highest levels of indicator bacteria are consistently observed in the more dense urban areas of Santa Cruz and Scotts Valley, which are sewered, indicating most of the bacterial contamination is more related to urban runoff than septic systems. Bacteria levels drop substantially as the River flows out of the suburban areas and through the State Parks or other low-density areas.

Livestock operations are also a potential source of bacterial contribution during storm periods. It is estimated there may be some 400-600 head of livestock kept in the watershed, primarily horses in commercial stables and small homeowner operations. Runoff from paddock areas, trails and manure stockpiles during storms can contribute elevated levels of fecal coliform, Cryptosporidium, and other organisms. Except where animals are allowed into creeks, stables are not a significant source of microbiologic contamination during nonstorm periods. County Environmental Health has had success with improvement of runoff and manure management at many of the larger operations. However, additional effort is needed.

As a part of this project, the County conducted extensive testing in the lower River area from 1995 through 1997 to better assess the sources of high bacteria in the urban reach of the River. The work found consistently high levels of bacteria downstream from the confluence with Branciforte Creek, which originate from storm drain discharge to the River and Branciforte Creek, as well as the concentrations of waterfowl that congregate in that area. Although the storm drains typically have very high bacteria levels, their dry weather flow is generally light and intermittent. High levels of bacteria in storm drains originate from decaying organic material (including garbage, leaves, and pet waste), occasional sewage spills, and possible subsurface leakage of sanitary sewer systems. Sewage leaks have been confirmed in several storm drains and subsequently corrected, resulting in a decline in bacteria levels in those drains. Leakage may persist in some drains. Since the 1997 sampling, the sewer lines in the vicinity of Branciforte Creek were upgraded and bacteria levels from the Creek have declined significantly. However, the general nonspecific urban contamination keeps the bacteria levels elevated well above standards for safe swimming. Storm sampling of ditches and gutters with no likely sewage influence frequently yielded high levels of indicator bacteria. It has not been confirmed whether pathogens are also present.

Water quality sampling using the four standard bacteria indicators was coupled with a health risk survey of persons in the water to determine the health risk of swimming in areas adjacent to the San Lorenzo River mouth as well as other areas designated as swimming/surfing areas. The health risk survey showed that there are generally low levels of indicator bacteria producing a good quality swimming water in the beaches adjacent to the mouth of the San Lorenzo River as well as upstream of the City of Santa Cruz in the San Lorenzo River. While the safe swimming standard was almost always exceeded at the mouth of the river only one person out of the 165 persons interviewed that had been swimming or wading in that area became ill. During the study, a total of 1325 people were interviewed at all areas. Eleven cases of illness from swimming were reported.

CHAPTER 3: HYDROLOGY, GEOMORPHOLOGY & WATER QUALITY

3.0 Introduction

This chapter describes the natural processes and human impacts that have influenced the landscape from which the District's water supply flows. The chapter begins with an overview of landscape evolution, describing the natural processes and human activities that have contributed to shaping the landscape. The chapter then provides an overview of the geology and soil types. Finally, the chapter discusses human impacts and land use activities in terms of their impacts to water quality.

Hydrology is the study of the distribution of water on and near the earth's surface. Because the amount of water is finite, it constantly moves through the hydrologic cycle in processes known as precipitation, infiltration, percolation and groundwater storage, evaporation and transpiration, and surface water runoff.

Geomorphology is the study of landforms, their origin and evolution, and the processes that shape them. Landforms can be characterized by their elevation, slope, orientation, stratification, rock exposure, and soil type. The science of geomorphology seeks to explain why landscapes appear the way they do, and it seeks to use this information to predict future changes. Landscapes include landforms, climatic factors, flora and fauna, and the built environment.

Scientists predict that climate change will increasingly impact the hydrologic cycle, but the degree and severity of the impacts of climate change on local watersheds and water supplies is not known. Scientific research applicable to the central California coast indicates that climate change will bring increasingly higher temperatures, more extreme droughts and more intense rainfall. All of these factors are expected to impact the local region's water resources. Chapter 7: Local Climate Change Assessment presents a more detailed discussion of the impacts of climate change, as well as potential adaptation and mitigation actions.

3.1 Overview of landscape evolution

This section begins with an overview of the geologic processes that formed and continue to shape the Santa Cruz Mountains as a region. It then describes the three geologic areas of the San Lorenzo River watershed, and their soil types. Finally, it summarizes the role of human influences on the landscape, resulting from land use changes that began about 200 years ago.

3.1.1 Geologic formation of the Santa Cruz Mountains

According to the theory of plate tectonics, the earth's crust is formed by a number of rigid plates, which move under (a process known as subduction) and against each other, causing major dynamic events, such as uplift of mountain ranges, and earthquakes (Harden, 1998). About 145 million years ago, the Farallon Plate began to collide with the North American Plate, resulting in the subduction of the Farallon plate. During this subduction, parts of the Farallon plate were scraped off onto the North American Plate in a process called accretion (Sloan, 2006). This accretion took place over a period of about 100 million years, producing the Mesozoic rocks in today's Bay Area (Sloan, 2006).

About 28 million years ago, the subduction of the Farallon Plate was complete, bringing the Pacific Plate into direct contact with the North American Plate. Movement between these two

Nitrates also lead to high concentrations of organic carbon. Organic carbon reacts with chemicals used in the disinfection process at water treatment plants. This interaction produces chemical by-products known as such as trihalomethanes (THMs), which pose long-term health threats (Camp, Dresser, & McKee, 1996).

The low flow summer period has the highest potential for biostimulation and other impacts to beneficial uses, so summer nitrate levels are of the highest concern (County of Santa Cruz, 1995). During the summer months, nitrate is also removed naturally from the river system at a rate of about 7% per mile, in both wet and dry years (County of Santa Cruz, 1995). This naturally occurring denitrification process occurs partially within the organic bottom sediments, and partially through uptake by riparian and aquatic vegetation (County of Santa Cruz, 1995). Without this natural denitrification process, nitrate loads in the streams would be expected to be five to ten times greater (County of Santa Cruz, 1995).

Algal influence on nitrates

In other watersheds, nitrogen levels have been observed to directly increase algae levels and to cause detrimental algal blooms. Studies have found that current elevated nitrate levels within the San Lorenzo River system do not seem to be the primary influence of algae growth in streams (County of Santa Cruz, 1995). Results from laboratory studies using *Cladophora spp* collected from the San Lorenzo River have shown no significant effect on algae growth from addition of nitrate and/or phosphate (County of Santa Cruz, 1995).

Algae levels in the San Lorenzo River are apparently at low enough levels in the San Lorenzo River so as not to be detrimental to fish, and may have been beneficial to anadromous fisheries (Gilchrest and Associates, 1984 as cited in County of Santa Cruz, 1995). The County of Santa Cruz (1995) reported that nitrate levels had no noticeable adverse effects on fishery resources, and little impact to recreation.

The County Nitrate Management Plan found that several species of nitrogen fixing algae are common to reaches of the San Lorenzo River; i.e., atmospheric sources of nitrogen are a source of water nitrates, due to these species.

Sources of nitrates

Nitrate enters surface waters primarily by seeping into the streams from septic system leach fields, community sewage disposal systems, runoff from confined animal facilities, and from urban runoff. According to watershed nitrate budgets calculated by the County of Santa Cruz (1995), 84% of the nitrate load in the middle San Lorenzo River is from non-natural sources.

> The daily summer nitrogen load from non-natural sources in the River at Big Trees is comparable to the load that would be generated by 500 houses discharging untreated sewage directly to the River (County of Santa Cruz, 1995).

The County of Santa Cruz (1995) has estimated that septic systems contribute an estimated 57% of the summer nitrate load in the San Lorenzo River. Nitrate levels increased dramatically in the 1970s as a direct result of development and poor septic system management, but increases since the 1990s have been low to insignificant due to management practices, control measures and enforcement (Santa Cruz, 1995 & 2000). Still, nitrate levels are approximately four times greater

today than levels in the 1960s. However, the Regional Board updated the nitrate objective when they adopted the TMDL for the San Lorenzo River. Currently, nitrate levels in the River are only about 1.5 times the present objective (Ricker, 2008).

In typical soils of the watershed, approximately 25% of the nitrogen from septic systems is removed by through natural denitrification in the upper soil layers, whereas in sandy soils only about 15% is removed and approximately 75-80% percolates as nitrate to ground water (Ramlit, 1982 as cited in County of Santa Cruz, 1995). In their studies, the County of Santa Cruz (1995) found that 10-25% of the nitrogen from septic systems in the sandy areas underlain by Santa Margarita Sandstone reached the streams as nitrate. The County of Santa Cruz also determined that a septic system in sandy soils contributes 10-15 times more nitrate to the river than a septic system in less permeable soils (County of Santa Cruz, 1995). Approximately 67% of the nitrate load in the river comes from the area of the watershed comprised of the highly permeable Santa Margarita sandstone (County of Santa Cruz, 1995). Therefore, management practices to reduce nitrogen inputs in the watershed will be the most effective in sandy areas.

The County of Santa Cruz and the Regional Board have taken actions to reduce nitrate levels in the watershed (Camp, Dresser, & McKee, 1996). The County of Santa Cruz (1995) found a 20% reduction in nitrate discharge from a shallow trench compared to a deep trench in septic systems in sandy soils. The San Lorenzo River Watershed Sanitary Survey (Berry, 2001) states that nitrate levels in the San Lorenzo River were decreasing slightly from previous levels. Nitrogen control measures and management practices are described in the San Lorenzo Draft Nitrate Management Plan Phase II Final Report (County of Santa Cruz, 1995), the Draft San Lorenzo River Watershed Management Plan Update, (County of Santa Cruz, 2001), in the San Lorenzo Valley and North Coast Watersheds Sanitary Survey (Camp Dresser & McKee, 1996), in the San Lorenzo River Nitrogen Control Measure project (White and Hecht, 1994), addressing the Quail Hollow Ranch Regional Park Stables, and in numerous Santa Cruz County Resource Conservation District (SCCRCD) documents.

The Boulder Creek Country Club sewage treatment facility has been upgraded for denitrification and tertiary treatment for possible use of reclaimed water on the golf course (County of Santa Cruz, 2000). If all other sources of nitrogen are controlled within this area, it is estimated that the San Lorenzo River between Boulder Creek and Ben Lomond could experience nitrate reductions as high as 75% (Berry, 2001).

The County Draft San Lorenzo Nitrate Management Plan (1995) states that livestock and stables contribute 6% of the present summer nitrate levels in the lower River at Felton. In sandy areas, a single horse without nitrate management practices contributes nitrate to streams comparable to rates from a single household in the same area (County of Santa Cruz, 1995). Horses in sandy soils contribute a higher percentage of the nitrogen load due to the highly permeable soils rapidly transporting the untreated waste. There are also high densities of horses in sandy soil areas. For example, horses contribute 41% of the estimated nitrate load in lower Zayante Creek (County of Santa Cruz, 1995). Horses and their contribution to nitrate within the watershed are one of the sources of highest potential reduction due to management practices. The County, the SCCRCD, Camp, Dresser & McKee and Balance Hydrologics have produced documents that contain simple and cost effective recommendations to reduce nitrogen loading from equestrian facilities and trails to ground and surface waters.

Areas where animal wastes are concentrated and left untreated on the surface elevate nitrogen and pathogen levels. This happens through runoff and percolation, especially with the "first flush" of stormwater. According to some studies, horses and horse facilities are one of the principle causes of elevated nitrogen and pathogens within the watershed (Camp, Dresser, & McKee; White & Hecht, 1994; County of Santa Cruz, 2001). Other confined animals such as dogs, cats and chickens also increase nitrate and pathogen pollution.

3.7.2.c Pathogens

Bacteria, virus, giardia, cryptosporidium, and other pathogens can make water unsafe for swimming, as well as require more expensive treatment for drinking water. Most testing for pathogens involves testing for indicator bacteria that would suggest the presence of pathogens from sewage, fecal contamination, or other contamination (County of Santa Cruz, 2001).

While indicator bacteria themselves do not necessarily cause illness, their presence causes warning signs to be posted at beaches, and significantly impacts recreational opportunities.

Sources of pathogens and indicator bacteria are non-point source urban runoff, failing septic systems, sewer system leaks, pet waste, livestock, feral pigs, encampments, and waterfowl. In natural settings, pathogens percolate into the soil where microbial organisms naturally decompose them.

The Watershed Sanitary Survey for the San Lorenzo and North Coast Watersheds (Camp, Dresser & McKee, 1996) found low to moderate levels of coliform bacteria in the tributaries of the San Lorenzo River, such as those that supply surface water to the District. These low levels result from the lack of development and the large areas of intact open space upstream of the water uptakes.

Domestic and commercial wastewaters potentially contain a number of pathogenic microorganisms that can cause diseases such as hepatitis, typhoid, cholera, dysentery, salmonella, giardiasis, and cryptosporidiosis (Camp, Dresser & McKee, 1996). Incompletely treated effluent may reach groundwater supplies or streams from an improperly functioning septic system. However, a properly functioning septic system will remove these pathogens within a short distance by microbial action in the soil.

The Department of Health Services (DHS) requires disinfection to treat pathogenic organisms, at all surface water treatment plants. If water supply sources are found to contain high levels of total coliform, DHS may increase the minimum disinfection requirements for that plant.

Sources of pathogens

The highest levels of indicator bacteria are consistently observed in more dense urban areas such as Scotts Valley and Santa Cruz, indicating that urban runoff and leaks in sewer systems, rather than septic tanks, are the main cause. As the river flows out of suburban areas and through State Parks or other low-density areas, bacteria levels drop substantially as stream flow picks up speed, and natural ecological processes take effect. After passing through the gorge, the river flows through the channelized and heavily developed area of downtown Santa Cruz. Here the river is subject to all the key contributors of pathogens: urban runoff, sewer leaks (within permeable alluvial soils), trash, pet wastes, homeless encampments, water fowl and general non-point human pollution. The river mouth continues to have high bacteria levels and is permanently posted as unsafe for swimming.

Urban runoff can be a source of fecal and total coliform bacteria in stream water. In an urban setting, non-permeable surfaces collect by-products of human activity, pet and animal wastes, and organic debris, holding them at the surface, until they are washed into streams by rain. Moderate to high coliform bacteria levels are frequently measured in the more urban lower San Lorenzo River (Camp, Dresser & McKee, 1996).

A vast majority of residents in the watershed are on private, individual septic systems. An estimated 14,000+ individual onsite septic systems exist in the 138 square miles San Lorenzo River watershed (County of Santa Cruz, 2000). Community sewer systems with treatment serve about 300 homes in the Boulder Creek Country Club, 30 homes in Rolling Woods, 54 homes at Bear Creek Estates, and the Mount Hermon Association (County of Santa Cruz, 2000). The Bear Creek Wastewater System is operated by the San Lorenzo Valley Water District. Both the Boulder Creek and the Rolling Woods wastewater systems are under the jurisdiction of the County Public Works Department (County of Santa Cruz, 2001). The Boulder Creek Country Club facilities have recently been upgraded and improved. All of these community systems including local schools are regulated by the Regional Water Quality Control Board (RWQCB).

The frequency of posting swimming areas in the watershed has also decreased significantly since the 1970s and 1980s due to the upgrading and improved maintenance of septic systems within the watershed. With improved management and monitoring summer bacteria levels have substantially improved, and the river generally meets all standards for safe swimming at all areas upstream of Santa Cruz (County of Santa Cruz, 2001).

The San Lorenzo and North Coast Watershed Sanitary Survey (Camp, Dresser & McKee, 1996) summarized the effects that the large numbers of septic systems have on coliform levels within the watershed:

> The absence of fecal coliforms in shallow groundwater underlying developed areas indicates that incidents of bacterial contamination of surface waters do not result from cumulative contamination of groundwater, but result from failures and discharges to the ground surface from individual systems. Rapid detection of failing septic systems under the Wastewater Management Program has anecdotally reduced the frequency of high microbial concentrations in the San Lorenzo River. The County found that human waste is not the primary source of fecal coliform in the San Lorenzo River based on fecal coliform to fecal streptococcus ratios. After many years of study, the County and Regional Board have concluded that the majority of existing septic systems do not consistently contribute significantly to the bacteria concentrations measured in the surface waters.

An evaluation of the County fecal coliform bacteria data, conducted by the County Health Services Agency, found no significant increase in bacteria in the swimming areas of the San Lorenzo River system.

Greywater systems are common throughout the San Lorenzo Valley and are often utilized to alleviate stress to septic systems with inadequate leaching capacity. Greywater systems collect and dispose of wastewaters originating from washing machines, showers and sinks. Although greywater contains fewer pathogens, solids and nutrients than toilet wastes it can still be a hazard to health and water quality.

According to the Santa Cruz County Environmental Health Services, bacterial concentrations in greywater from shower or bath water can reach 400,000 fecal coliforms and 3 million total coliforms/100 milliliter (ml). Washing machine wastewater can range from 2,000 to 10 million fecal coliforms/100ml. In addition, there are roughly 200 enteric virus/liter of undisinfected greywater from showers and baths and 3,000 viruses/liter from washing machines. County policy requires connection of all greywater to an adequately sized septic system but probably allows installation of at least 25 to 50 greywater sumps each year under appropriate conditions (Camp, Dresser & McKee, 1996).

A marked decrease in septic system failures has occurred since the time when the San Lorenzo Valley was being converted from summer homes to permanent residences. The Santa Cruz County Health Services Agency reported that, "Since 1986, the wintertime septic failure rate has declined from 5-14% to 1-3% depending on the area" (County of Santa Cruz, 2001).

Another source of pathogens is from equestrian trails, paddock areas, and manure stockpiles, which can contribute elevated levels of fecal coliform, Cryptosporidium, and other organisms (County, 2001). Other sources of pathogens are pets, livestock, waterfowl, decaying garbage, homeless encampments, sewage leaks, and general nonpoint urban pollution (County of Santa Cruz, 2000 & 2001). The potential for erosion from horseback riding and the introduction of fecal matter from horses may be significant, especially at stream crossings. However, the effect of horseback riding cannot be quantified separately from other sources which contribute microbial contaminants and turbidity/sediment (Camp, Dresser & McKee, 1996).

Homeless encampments near creeks may dispose of human waste directly into the streams. Even if latrines are dug, the encampments are often within the floodplain. Encampments effect riparian vegetation and concentrate trash. Homeless encampments directly elevate levels of sediment, pathogens, nitrate and particulate contaminants in streams.

3.7.2.d Toxic compounds

Toxic compounds include synthetic organic chemicals (SOCs); volatile organic compounds (VOCs), which include fuel, oil, gasoline, and MTBE; heavy metals, including lead, zinc and cadmium, pesticides, PCBs, oil and grease. The presence of toxic compounds in the San Lorenzo River has primarily resulted from discharge of VOCs from leaking underground storage tanks.

Drinking water aquifers in Scotts Valley and some other localized parts of the watershed have been contaminated by these toxic compounds, which has required discontinuance of wells and/or expensive treatment (County of Santa Cruz, 2001).

Past studies in the San Lorenzo River watershed have indicated low to nondetectable levels of heavy metals, pesticides, PCB's, oil and grease in the San Lorenzo River. There have been no documented impacts on organisms or beneficial uses of the River resulting from toxic constituents in urban runoff. Very low levels of only a small number of trace organic compounds (pesticides and PCB's) were found, at only 2-7% of the level considered hazardous (County of Santa Cruz, 2001).

Elevated levels of lead, zinc, and cadmium have been found, but none of the compounds were found at levels that are known to cause a threat to human or biotic health. Zinc and cadmium are

ANNUAL REPORT

General Permit for the Discharger of Storm Water from Small Municipal Separate Storm Sewer Systems (General Permit)

(See Small MS4 Annual Report Guidance for additional guidance on completing this Annual Report Form)

Check box if this is a new name, address, etc.

A. Permittee Information

1. Permittee (Agency Name): Los Osos Community Services District ☐
2. Contact Person: Dan Gilmore, General Manager ☒
3. Mailing Address: P.O. Box 6064 ☐
4. City, State and Zip Code: Los Osos, CA 93412 ☐
5. Contact Phone Number: 805-528-9370 ☐
6.. WDID # 3 40MS05105
7. Have any areas been added to the MS4 due to annexation or other legal means? ☐ YES ☒ NO

   If YES

Outfall	Has map been updated?		Has SWMP been updated?		Receiving Water Name
	YES	NO	YES	NO	

8. Are you subject to the Design Standards contained in Attachment 4 of the General Permit? ☐ YES ☒ NO

   If yes, report on the implementation of the Design Standards in section D.5 of this Annual Report Form.

B. Reporting Period (check one): ☒ Coverage Commencement (Feb 23, 2009 to Jan 31, 2010)

C. Executive Summary

This is the Los Osos Community Service District's (LOCSD) first annual report to the State Water Quality Control Board. The LOCSD Storm Water Management Program (SWMP) is a program to implement Best Management Practices (BMP) to help reduce the discharge of pollutants into waterways and to protect water quality from impacts due to storm water runoff to the Maximum Extent Practicable (MEP). The LOCSD SWMP was approved by the Central Coast Regional Water Quality Control Board on February 23, 2009 at which time the District was granted permit coverage under the National Pollutant Discharge Elimination System General Permit Order Number 2003-0005-DWQ (General Permit). The coverage period of the first year is from February 2009 through January 2010. The County's jurisdiction includes the storm water runoff generated from the streets, construction, and post construction of the Los Osos/Baywood Park community and therefore the County's NPDES permit encompasses BMPs that address those services. The District's SWMP outlines a five year plan to establish BMPs to help reduce the discharge of pollutants into waterways and the back bay from facilities owned and operated by the District. The District coordinates with the County for public

outreach, education, and involvement programs designed to reach the entire Los Osos/Baywood Park community.

The LOCSD filed for Chapter 9 Bankruptcy protection on August 25, 2006 and has been undergoing reorganization since that time. The past few years has seen a reduction in personnel including the Utility Systems Manager, Administrative Services Manager, the Accounts Payable Bookkeeper, and two Utility Department crew. There have been a few turnovers in the General Manager position since the bankruptcy. The District continues to function and duties from the vacated positions have been reassigned. Despite the changes at the District, the overall effectiveness of our program has been very good during this first year of coverage. The public education and outreach was enhanced through partnerships with other agencies and non-profit organizations. The Morro Bay National Estuary Program awarded the LOCSD a grant to reproduce an educational board game from the Sammy Steelhead Activity Guide onto environmentally sensitive canvas. The unveiling and subsequent uses will be documented in the next annual report since the project was completed after this reporting period. Without grant money we would not have the funds to produce this interactive game which will convey the storm water pollution prevention message to school-age children and adults. Any money saved through partnerships and grants is very much appreciated by the District Board of Directors and staff.

The LOCSD SWMP is in compliance with the General Permit. As stated earlier, the County has land use authority in Los Osos and therefore is responsible for the control of construction site runoff. Our municipal operations have improved in the past year, with upgrades to the storm drain pump station at 16th and Paso Robles Street, 8th Street & El Moro drainage pumps, and the water operations facility at 8th Street & El Moro to accommodate backwashing of iron/manganese filters.

The most successful area of the SWMP is the public education and outreach due to participation with other agencies through the Central Coast Partners for Water Quality, headed by the County of San Luis Obispo. This partnership has allowed us to share resources, develop educational programs, and participation information, while keeping costs at a minimum. The WaterFest 2009 event was headed by Partner members along with help from the State Parks, City of Morro Bay, the Morro Bay National Estuary Program, LOCSD, and Cal Poly and was held at Morro Rock State Preserve.

The most challenging part of the program has been our ability to address all the BMPs in the Municipal Operations section of our SWMP. Due to the financial situation of the District we opted out of providing a clean-up day for our public. When this service was provided in October 2008, we had a total cost of $10,420.00 before donations. So, the LOCSD staff decided to discontinue this annual service. Since we are the franchisee of Mission Country Disposal, we continue to promote their week-long special pick-up days twice a year. This gives the community a chance to discard the large bulky items and in turn reduces the impact of pollutants from items being stored around town in the right-of-way. The District believes that all of the BMPs approved under the SWMP are still appropriate storm water pollution mitigation measures. An amendment to the LOCSD SWMP will be provided to address the changes in personnel.

D. Minimum Control Measures

Report on the status and effectiveness of BMPs and measurable goals by completely answering the following questions. Include any proposed modifications to the SWMP and anticipated changes to the schedule. You may use the tables provided and use narrative sections to highlight information. Alternatively, you may wish to only provide information in a narrative format. If the "Status of Measurable Goals" question is completely addressed by the table, you may write "see table" in that narrative section.

1. Public Education and Outreach

BMP	*Description*	*Status*					
		Implemented	Not Applicable	Modified	Effective	Unknown	Not Effective
PE1-1	Involvement with the MBNEP	X			X		
PE1-2	Vector Control FAQ Sheet	X			X		
PE1-3	Bear Pride Newsletter & District Website	X		X	X		
PE1-4	Educational Presentations for school age children	X			X		
PE1-5	Educational Paraphernalia	X			X		

APPENDIX A-30

Los Osos Baywood Park Individual and Community Sewage Disposal System Prohibition Area

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

RESOLUTION NO. 83-13

Revision and Amendment of Water Quality Control Plan by the Addition of a Prohibition of Waste Discharge from Individual Sewage Disposal Systems Within the Los Osos/Baywood Park Area, San Luis Obispo County

WHEREAS, the California Regional Water Quality Control Board, Central Coast Region (hereafter Regional Board), adopted the Water Quality Control Plan for the Central Coastal Basin (hereafter Basin Plan) on March 14, 1975; and,

WHEREAS, the Regional Board, after notice and public hearing in accordance with Water Code Section 13244, periodically revises and amends the Basin Plan to ensure reasonable protection of beneficial uses of water and prevention of pollution and nuisance; and,

WHEREAS, in protecting and enhancing water quality, the Basin Plan specifies certain areas where the discharge of waste, or certain types of waste, is prohibited; and,

WHEREAS, Article 5, Chapter 4, Division 7, of the California Water Code defines criteria for such prohibition areas (Section 13240 et seq.); and,

WHEREAS, Los Osos/Baywood Park is an unincorporated community, with a 1980 population of 10,933 persons located south of the City of Morro Bay, in San Luis Obispo County; and,

WHEREAS, current zoning will accommodate a population in excess of 27,000 people and an average residential lot size of about 6600 ft^2; and,

WHEREAS, on-site soil absorption or evapotranspiration systems are the sole means of wastewater disposal in the Los Osos/Baywood Park area; and,

WHEREAS, the Los Osos/Baywood Park area soil permeability is rapid and there are substantial areas with high groundwater; and,

WHEREAS, the majority of lots are too small to provide adequate dispersion of individual sewage disposal system effluent; and,

WHEREAS, the San Luis Obispo County Environmental Health Department has provided documentation concerning the problem of liquid waste disposal in the Los Osos/Baywood Park area; and,

WHEREAS, the County of San Luis Obispo is preparing an environmental impact report (EIR) in accordance with the California Environmental Quality Act and a project report that identifies adverse environmental impacts from continued use of septic tanks in the Los Osos/Baywood Park area and discusses alternatives to existing wastewater management practices; and,

WHEREAS, "Los Osos-Baywood Park/Phase I Water Quality Management Study" cites conditions which constitute contamination and pollution as defined in Section 13050 of the California Water Code; and,

WHEREAS, chemical analyses of wells in Los Osos/Baywood Park indicates 38% of the shallow wells tested in the Phase I study, taking water from the Old Dune Sands deposits portion of the qauifer, contain nitrate concentrations which exceed State Health Department Drinking Water Standards of 45 milligrams per liter; and,

WHEREAS, bacterial analyses of 42 wells tested in the Phase I study resulted in 26 wells indicating total coliform in violation of State Health Drinking Water Standards, and 2 wells indicating fecal coliform in violation of Basin Plan limits for groundwater; and,

WHEREAS, surface water bacterial analyses tested in the Phase I study indicated total and fecal coliform levels exceeding Basin Plan recommended limits for water contact recreation (REC-1); and,

WHEREAS, a letter from the California Health and Welfare Agency, Department of Health Services, states their concerns regarding the high nitrate levels in the waters of Los Osos/Baywood Park area, and recommends adequate measures be taken to correct the nitrate problems to bring the waters into compliance with California Drinking Water Standards; and,

WHEREAS, a letter from the San Luis Obispo County Health Agency Director cites violation of the public health limit for nitrates and recommends elimination of shallow groundwater usage and adoption of a discharge prohibition; and,

WHEREAS, the Regional Board is obligated to include a program of implementation for achieving water quality objectives in its Basin Plan; and,

WHEREAS, present and anticipated future beneficial uses of Los Osos/Baywood Park creeks include recreation and aquatic habitat; and,

WHEREAS, Los Osos Basin groundwaters are suitable for agricultural, municipal, domestic, and industrial water supply; and,

WHEREAS, a Regional Board staff report finds beneficial uses of Los Osos ground and surface waters are adversely affected by individual sewage disposal system discharges, there appears to be a trend of increasing degradation, and public health is jeopardized by occurrences of surfacing effluent; and,

WHEREAS, drafts of proposed revisions and amendments of the Basin Plan, prohibiting discharges from Los Osos/Baywood Park individual sewage disposal systems, have been prepared and provided to interested persons and agencies for review and comment; and,

WHEREAS, Regional Board staff has prepared documents and followed appropriate procedures to satisfy the environmental documentation requirements of both the California Environmental Quality Act, under Public Resources Code Section 21080.5 (Functional Equivalent), and the Federal Clean Water Act of 1977 (PL 92-500 and PL 95-217), and the Regional Board finds adoption of this prohibition area will not have a significant adverse effect on the environment; and,

WHEREAS, on September 16, 1983, in the San Luis Obispo City Council Chambers, 990 Palm Street, San Luis Obispo, California, after due notice, the Regional Board conducted a public hearing at which evidence was received pursuant to Section 13281 of the California Water Code concerning the impact of discharges from individual sewage disposal systems on water quality and public health; and,

WHEREAS, pursuant to Section 13280 of the California Water Code, the Regional Board finds that discharges of wastes from new and existing individual disposal systems which utilize subsurface disposal in the affected area will result in violation of water quality objectives; will impair beneficial uses of water; will cause pollution, nuisance, or contamination; and will unreasonably degrade the quality of waters of the State; and,

WHEREAS, the Regional Board finds the aforestated conditions in need of remedy to protect present and potential beneficial uses of water and to prevent pollution and nuisance.

NOW, THEREFORE, BE IT RESOLVED, that the Water Quality Control Plan, Central Coastal Basin, be amended as follows:

Page 5-66, after Item 7, following the legal description for Pasatiempo Pines (added by Resolution 83-09), insert the following prohibitions:

"8. Discharges of waste from individual and community sewage disposal systems are prohibited effective November 1, 1988, in the Los Osos/ Baywood Park area, and more particularly described as:

"Groundwater Prohibition Zone

(Legal description to be provided for area prescribed by Regional Board).

"Failure to comply with any of the compliance dates established by Resolution 83-13 will prompt a Regional Board hearing at the earliest possible date to consider adoption of an immediate prohibition of discharge from additional individual and community sewage disposal systems."

Discharges from individual or community systems within the prohibition area in excess of an additional 1150 housing units (or equivalent) are prohibited, commencing with the date of State Water Resources Control Board approval.

BE IT FURTHER RESOLVED, that the above area is consistent with the recommendations of the staff report as shown on "Attachment A."

BE IT FURTHER RESOLVED, that the Regional Board does intend standard exemption criteria, first paragraph of Page 5-67 of the Basin Plan, to apply to this action.

BE IT FURTHER RESOLVED, that compliance with the above prohibition of existing individual or community sewage disposal systems shall be achieved according to the following time schedule:

Task	Compliance Date
Begin Design	November 1, 1984
Complete Design	November 1, 1985
Obtain Construction Funding	December 1, 1985
Begin Construction	April 1, 1986
Complete Construction	November 1, 1988

BE IT FURTHER RESOLVED, that reports of compliance or noncompliance with schedules shall be submitted to the Regional Board within 14 days following each scheduled date unless otherwise specified, where noncompliance reports shall include a description of the reason, a description and schedule of tasks necessary to achieve compliance, and an estimated date for achieving full compliance.

BE IT FURTHER RESOLVED, the County will continue a monitoring program, approved by the Regional Board staff, that will monitor ground water quality within the prohibition boundaries as set forth in this resolution, and also a monitoring program which covers areas outside the prohibition boundaries but within the urban reserve line as shown in Attachment A.

BE IT FURTHER RESOLVED, that the Regional Board has determined this action will not have a significant adverse impact on the environment and the Executive Officer of the Regional Board is hereby directed to file a Notice of Decision to this effect with the Secretary of the Resources Agency.

BE IT FURTHER RESOLVED, that the State Water Resources Control Board is hereby requested to amend forthwith the Clean Water Grant Project Priority List to recognize the necessary structural solution for Los Osos/Baywood Park as a Priority "A" project.

BE IT FURTHER RESOLVED, that if the Board holds a hearing and adopts an immediate prohibition as described above, the prohibition is effective as of the date the Regional Water Quality Control Board adopts a prohibition of discharge from additional individual and community sewage disposal systems.

BE IT FURTHER RESOLVED, the Executive Officer of the Regional Board is hereby directed to submit this revision of the Basin Plan to the State Water Resources Control Board for approval pursuant to Section 13245 of the California Water Code.

BE IT FURTHER RESOLVED, upon approval by the State Water Resources Control Board, Chapter 5 of the Water Quality Control Plan is revised by the addition of the above prohibition.

I, KENNETH R. JONES, Executive Officer of the California Regional Water Quality Control Board, Central Coast Region, do hereby certify the foregoing is a full, true, and correct copy of a Resolution adopted by the California Regional Water Quality Control Board, Central Coast Region, on September 16, 1983.

Executive Officer

ATTACHMENT A (FIGURE 10)

PROHIBITION BOUNDARY MAP

State of California

ADOPTED BY STATE BOARD ON Jan 19, 1984

The Resources Agency of California

Memorandum

To : State Water Resources Control Board
Division of Technical Services

Attention: Mr. Walter G. Pettit, Chief

Date: September 27, 1983

From : **California Regional Water Quality Control Board**
Central Coast Region—1122 Laurel Lane
San Luis Obispo, California 93401

Subject: BASIN PLAN AMENDMENT, RESOLUTION 83-13

On September 16, 1983, the Regional Board approved Resolution 83-13, "Revision and Amendment of Water Quality Control Plan by the Addition of a Prohibition of Waste Discharge from Individual Sewage Disposal Systems within the Los Osos/Baywood Park Area, San Luis Obispo County." We hereby request State Board review and approval.

All materials presented to the public and Regional Board are included as follows:

A. Adopted Resolution.

B. Regional Board "Blue Sheets" Agenda Item No. 6.

C. Basin Plan and Resolution wording change developed during the course of the Regional Board Hearing.

D. CEQA Compliance Documents
1. Notice of Filing
2. Environmental Checklist
3. Notice of Decision
4. Staff Report.

E. Mailing List.

F. Comment Letters
1. Compilation of names and addresses
2. summary of comment letters
3. Staff response letter to comment letters (mass mailed).

G. Over-head slides presented at September 16, 1983, Regional Board Hearing.

H. Photo-Log and slides presented at September 16, 1983, Regional Board Hearing.

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ALTERNATIVES TO THE PROJECT

1. No action: If the proposed resolution is not adopted, existing water quality problems will continue. Problems are caused by high nitrates, surfacing effluent and effluent migration to surface waters from existing individual on-site disposal systems within the prohibition area. The threat to public health, as noted by the "Phase I Water Quality Management Study," and the San Luis Obispo County Health Department, will also continue. The potential for Los Osos/Baywood Park to receive Clean Water Grant funds would be small, leaving the residents of Los Osos/Baywood Park with the burden of funding a solution.

2. Adoption of more restrictive standards: The proposed prohibition is appropriate both in terms of area and time constraints. A more restrictive standard would be to enlarge the prohibition area and reduce the time period to cease discharge from existing on-site disposal systems within the prohibition area. This more restrictive standard would not be supported by the following criteria established for developing the prohibition area and time schedule:

   a. Areas with wells showing nitrate concentration exceeding State Health Department Drinking Water Standards.

   b. Rapid percolating soil.

   c. Shallow depth to groundwater.

   d. One hundred foot set-back from surface waters and wells for wastewater disposal systems.

   e. Lot sizes less than one-half acre in size.

   f. History and areal distribution of system failures and complaints.

3. Adoption of less restrictive standards: The response to this alternative relates to the discussion above, under more restrictive standards. A less restrictive standard might allow the existing residences within the prohibition to continue using their on-site disposal systems indefinitely by establishing an on-site system maintenance district or by increasing homeowner maintenance. This solution is not recommended due to criteria outlined above. The prohibition area residences and parcels violate all or part of these criteria. An on-site maintenance district would not solve these on-site disposal system problems. Rapid percolation soils and high groundwater cause inadequately treated effluent to reach groundwater. Also, surfacing or high groundwater in some areas causes surfacing effluent. These problems would not be solved by increasing the frequency of septic tank pumping.

ENVIRONMENTAL CHECKLIST FORM

D-2

I. BACKGROUND

1. Name of Proponent California Regional Water Quality Control Board, Central Coast Region

2. Address and Phone Number of Proponent:

   1102 A Laurel Lane

   San Luis Obispo, CA 93401

   (805) 549-3147

3. Date of Checklist Submitted August 1, 1983

4. Agency Requiring Checklist Resources Agency

5. Name of Proposal, if applicable Basin Plan Amendment for Los Osos/Baywood Park Area, San Luis Obispo County, Resolution No. 83-13

II. ENVIRONMENTAL IMPACTS

(Explanations of all "yes" and "maybe" answers are required on attached sheets.)

	YES	MAYBE	NO
1. Earth. Will the proposal result in:			
a. Unstable earth conditions or in changes in geologic substructures?			X*
b. Disruptions, displacements, compaction or overcovering of the soil?			X*
c. Change in topography or ground surface relief features?			X*
d. The destruction, covering or modification of any unique geologic or physical features?			X*
e. Any increase in wind or water erosion of soils, either on or off the site?			X*
f. Changes in deposition or erosion of beach sands, or changes in siltation, deposition or erosion which may modify the channel of a river or stream or the bed of the ocean or any bay, inlet or lake?			X*

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4. Plant Life. Will the proposal result in:

a. Change in the diversity of species, or number of any species of plants (including trees, shrubs, grass, crops, microflora and aquatic plants)?			X
b. Reduction of the numbers of any unique, rare or endangered species of plants?			X
c. Introduction of new species of plants into an area, or in a barrier to the normal replenishment of existing species?			X
d. Reduction in acreage of any agricultural crop?			X

5. Animal Life. Will the proposal result in:

a. Change in the diversity of species, or numbers of any species of animals (birds, land animals including reptiles, fish and shellfish, benthic organisms, insects or microfauna)?			X
b. Reduction of the numbers of any unique, rare or endangered species of animals?			X
c. Introduction of new species of animals into an area, or result in a barrier to the migration or movement of animals?			X
d. Deterioration to existing fish or wildlife habitat?			X

6. Noise. Will the proposal result in:

a. Increases in existing noise levels?			X*
b. Exposure of people to severe noise levels?			X

7. Light and Glare. Will the proposal produce new light or glare?			X
8. Land Use. Will the proposal result in a substantial alteration of the present or planned land use of an area?			X

9. Natural Resources. Will the proposal result in:

a. Increase in the rate of use of any natural resources?			X*
b. Substantial depletion of any nonrenewable natural resource?			

10.	Risk of Upset. Does the proposal involve a risk of an explosion or the release of hazardous substances (including, but not limited to, oil, pesticides, chemicals or radiation) in the event of an accident or upset conditions?			X
11.	Population. Will the proposal alter the location, distribution, density, or growth rate of the human population in the area?	X		
12.	Housing. Will the proposal affect existing housing, or create a demand for additional housing?	X		
13.	Transportation/Circulation. Will the proposal result in:			
	a. Generation of substantial additional vehicular movement?			X
	b. Effects on existing parking facilities, or demand for new parking?			X
	c. Substantial impact upon existing transportation systems?			X
	d. Alterations to present patterns of circulation or movement of people and/or goods?			X
	e. Alterations to waterborne, rail or air traffic?			X
	f. Increase in traffic hazards to motor vehicles, bicyclists or pedistrians?			X*
14.	Public Services. Will the proposal have an effect upon, or result in a need for new or altered governmental services in any of the following areas:			
	a. Fire protection?			X
	b. Police protection?			X
	c. Schools?			X
	d. Parks or other recreational facilities?			X
	e. Maintenance of public facilities, including roads?			X*
	f. Other governmental services?			X*

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15. Energy. Will the proposal result in:

a. Use of substantial amounts of fuel or energy?			X*
b. Substantial increase in demand upon existing sources of energy, or require the development of new sources of energy?			X

16. Utilities. Will the proposal result in a need for new systems, or substantial alterations to the following utilities:

a. Power or natural gas?			X
b. Communications systems?			X
c. Water?			X
d. Sewer or septic tanks?	X		
e. Storm water drainage?			X
f. Solid waste and disposal?			X

17. Human Health. Will the proposal result in:

a. Creation of any health hazard or potential health hazard (excluding mental health)?			X
b. Exposure of people to potential health hazards?			X

18. Aesthetics. Will the proposal result in the obstruction of any scenic vista or view open to the public, or will the proposal result in the creation of an aesthetically offensive site open to public view?			X
19. Recreation. Will the proposal result in an impact upon the quality or quantity of existing recreational opportunities?			X
20. Archeological/Historical. Will the proposal result in an alteration of a significant archeological or historical site, structure, object or building?		X*	

21. Mandatory Findings of Significance.

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degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory? ___ ___ X

b. Does the project have the potential to achieve short-term to the disadvantage of long-term, environmental goals? (A short-term impact on the environment is one which occurs in a relatively brief, definitive period of time which long-term impacts will endure well into the future.) ___ ___ X

c. Does the project have impacts which are individually limited, but cumulatively considerable? (A project may impact on two or more separate resources where the impact on each resource is relatively small, but where the effect of the total of those impacts on the environment is significant). ___ ___ X

d. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly? ___ ___ X

III. DISCUSSION OF ENVIRONMENTAL EVALUATION

IV. DETERMINATION

On the basis of this initial evaluation:

X I find the proposed project COULD NOT have a significant effect on the environment.

___ I find that the proposed project may have a significant adverse impact on the environment. However, there are feasible alternatives and/or feasible mitigation measures available which would substantially lessen any significant adverse impact. These alternatives and mitigation measures are discussed in the attached written report.

___ I find that the proposed project MAY have a significant effect on the environment. There are no feasible alternatives and/or feasible mitigation measures available which would substantially lessen any significant adverse impacts. See the attached written report for a discussion of this determination.

Date _____ _____
(Signature)

009337

DISCUSSION OF ENVIRONMENTAL EVALUATION

General Statement

This resolution has a direct impact on Clean Water Grant (CWG) funding for the Los Osos/Baywood Park area. By establishing a prohibition, this project will be given an A priority, greatly increasing its funding potential. Therefore, this resolution may eventually lead to a construction project to solve on-site sewage disposal system problems. Impacts on the environmental checklist marked with an asterisk (*) are construction related impacts. These will be addressed in an environmental impact report prepared for the construction project by San Luis Obispo County.

Environmental Impacts	Mitigation Measures
Item 3d	
Surface water flow in local creeks will be reduced by an insignificant amount due to prohibition of discharge. Creek flow is currently augmented by migration of effluent with groundwater.	None required. Streams are intermittent. Reduction in flow will be insignificant.
Item 3e	
Surfacing effluent in high groundwater areas and subsurface effluent flowing to the creek causes a potential public health threat. It also may decrease dissolved oxygen and increase nutrients.	None required. Prohibition will improve creek water quality.
Item 3f	
Rate and amount of flow of groundwater will be reduced by prohibition of septic tank discharge.	Flow reduction to groundwater can be mitigated by requiring any collected sewage to be adequately treated and allowed to percolate back to groundwater.
Items 11 and 12	
This prohibition will, in the short term, prevent continued development in this area, until a solution for on-site wastewater disposal system pollution is found.	None required. This is an interim impact. The Prohibition will correct an existing and growing water quality and public health problem. This area has already provided housing in excess of densities recommended when septic tanks are used.

D-3

NOTICE OF DECISION

TO: Secretary for Resources
1416 Ninth Street, Room 1311
Sacramento, CA 95814

FROM: Central Coast Regional Water Quality Control Board
1102 A Laurel Lane
San Luis Obispo, CA 93401

SUBJECT: Filing of Notice of Decision in Compliance with Section 21080.5 of the Public Resources Code

Project Proponent: Central Coast Regional Water Quality Control Board

Project Title: Resolution No. 83-13

Contact Person: Roger Briggs Telephone Number: 8-629-3147

Project Location: Los Osos/Baywood Park, San Luis Obispo County

Project Description:* Resolution No. 83-13 revises and amends the Water Quality Control Plan by the addition of a Prohibition of Waste Discharge from Individual and Community Sewage Disposal Systems within the Los Osos/Baywood Park area of San Luis Obispo County. This Prohibition will lead to the correction of a ground water contamination and potential public health threat due to high nitrates from subsurface waste water disposal systems and surfacing effluent due to high ground water. This is documented in the "Phase I Water Quality Management Study" Vol I and II, dated April, 1983, and in Resolution 83-13's staff report.

This is to advise that the Central Coast Regional Water Quality Control Board has made the following determination regarding the above described project:

The project has been: [X] approved

[ ] disapproved

Date Received for Filing:

September 16, 1983

Signature of Person Filing Notice

Executive Officer

Title

*Describe proposed basin plan amendment, location of affected area, and the purpose and justification for the proposed amendment.

009339

I. INTRODUCTION

Los Osos/Baywood Park is a coastal community just south of the City of Morro Bay. Prior to 1950, there was little development in Los Osos/Baywood Park and the population was only 600 people. There was considerable residential development in this area over the next three decades. The 1980 census population was 10,933 people. This represents a 1722% increase in population since 1950. This population increase has led to several problems, one involving wastewater discharged from private systems.

Shallow Los Osos groundwater quality has been degrading due to sewage effluent discharges from individual and community on-site wastewater disposal systems. A number of reports and studies have been made to identify and quantify this problem. These reports indicate nitrate concentrations have increased in the Los Osos groundwater basin in proportion with residential development, leading to a public health hazard. This staff report and proposed resolution for a Basin Plan amendment are based on reports and studies, listed as follows:

- Brown and Caldwell Consulting Engineers, April, 1983, "Phase I Water Quality Management Study," Clean Water Grant Project No. C-06-1648.

- Department of Water Resources, October, 19~~83~~73, "Los Osos/Baywood Park Ground Water Investigation."

- San Luis Obispo County Health Department files on Public Complaints Investigation in Los Osos/Baywood Park.

- "Geohydrology and Water Quality - Baywood/Los Osos Ground Water Basin, San Luis Obispo County, California" State Water Resources Control Board report prepared by Mr. Richard Zipp.

Other problems associated with these individual on-site wastewater disposal systems include failures and poor performance due to high ground water and small lot sizes. Also, rapid percolating soils and high ground water prevent adequate treatment of wastewater effluent leading to a potential health threat from bacterial contamination of ground water.

II. AREA DESCRIPTION

A. Community

Los Osos/Baywood Park is located at the western end of Los Osos Valley immediately south of the City of Morro Bay in the County of San Luis Obispo (Figure 1). Population versus time is indicated in Table 1 and Figure 2. The majority of lots were subdivided in the early 1900's. Infilling on lots of record represents a large potential for population increase. Additional land divisions are also likely in many areas with large parcels.

drinking water standards. Had the County taken samples during the summer months, nitrate concentrations should have been considerably higher.

III. A. High Ground Water

High ground water is another concern in Baywood/Los Osos. Figure 8 indicates areas where groundwater is within 15 and 25 feet of ground surface. Information for this map was obtained from the County Engineering Department. Figure 9 shows areas, identified by a County Engineering report (Appendix I) and San Luis Obispo County Health Department, having extremely high ground water. Appendix I also refers to about 50 small areas with surfacing groundwater, principally in the Baywood Park area. All of these areas were referred to as potential public health threats due to the high ground water causing sewage disposal system failures and surfacing effluent. The County Health Department has some complaints of failures on file which were referred to the County Building Department (Appendix C). The County Building Department, who has regulatory responsibility for the on-site disposal systems, has not kept records on the follow-up of these failures, according to Mr. Phil Wachtel, Chief Building Inspector. Mr. Wachtel indicated the County Building Department didn't feel these failures were numerous enough to be significant. He stated the failures related to older systems or high groundwater (note Appendix D and E). Septic system failures are also discussed in a County Health Department letter to the Coastal Commission (Appendix F).

IV. SURFACE WATER QUALITY

The Brown and Caldwell Phase I report identified surface water bacterial levels which may exceed the Regional Water Quality Control Board's "Basin Plan" recommended limits for water contact recreation (REC-1) in Los Osos Creek and Eto Creek. Los Osos Creek is designated for contact recreation. The Phase I report neglected to determine if the contamination was human or animal. Therefore, in a letter dated July 26, 1983, (Appendix G), Regional Board staff requested the County Health Department to conduct additional well and surface water sampling. The samples will be taken over a one year period on a quarterly basis. The first quarter's results should be available by the September 16, 1983, public hearing. The results will help to determine the source of surface water bacterial contamination.

V. PROJECT FUNDING STATUS

San Luis Obispo County is currently preparing a Step 1 Facilities Plan for wastewater management in Baywood/Los Osos. As previously discussed, Brown and Caldwell Consulting Engineers have completed Phase I and are developing Phase II. This will include alternative evaluations, a recommended project, an environmental impact report, and a financial and revenue plan. Further, Clean Water Grant funding is one possible means of funding a proposed project. Los Osos/Baywood Park is currently in an "E" priority on the State's priority list (unfundable) due to lack of

VI. B. Prohibition in Los Osos/Baywood Park

As indicated in the Brown and Caldwell Phase I report, there is evidence of human waste contamination of ground water in the Los Osos ground water basin. "Contamination" constitutes "pollution" as defined in Section 13050 of the Water Code. This degradation is due primarily to discharges from on-site wastewater disposal systems and establishes a basis for a prohibition of discharges in the Los Osos/Baywood Park area. This contamination has led to a public health hazard due to high nitrate concentrations and fecal coliform counts exceeding State Health Department drinking water standards.

In addition, there is a preliminary indication that surface waters are also being contaminated by on-site systems. The contamination detected hasn't, as yet, been identified as coming from human sources. This information will hopefully be available prior to the September 16, 1983, meeting.

Finally, unacceptably high ground water has caused on-site system failures on a seasonal basis in specific areas of Baywood/Los Osos. These failures are a threat to public health. Any of these factors are adequate grounds for discharge prohibition in pertinent areas.

The following section discusses factors which the Board must consider in establishing a prohibition in Baywood/Los Osos (Section 13281 CWC):

a. Past, present, and probable beneficial uses of water.

Present and anticipated future uses of Los Osos Creek include recreation and aquatic habitat. Currently, the groundwater from the deeper reaches of the ground water basin is suitable for agricultural, municipal, domestic, and industrial water supply. These current beneficial uses will not change in Los Osos/Baywood Park, provided action is taken now to prevent these deeper ground water sources from being contaminated like the ground water in the upper reaches of the ground water basin. As discussed previously, shallow ground water was used for municipal supply (CSD #9) until nitrate contamination curtailed this usage. Shallow ground water is still used for domestic water supply, to a limited extent in some private wells.

The California State Legislature has determined that the people of the state have a primary interest in the conservation, control, and utilization of the water resources of the state, and that the quality of all waters of the state shall be protected for use and enjoyment by the people of the state. Activities and factors which may affect water quality shall be regulated to attain the highest water quality which is reasonable, considering all demands being made and to be involved, beneficial and detrimental, economic and social, tangible and intangible. Wastewater discharges are to be treated to protect present and future beneficial uses, and, where feasible, to restore past beneficial uses.

d. Economic Considerations

Project costs have not been estimated for this project. Brown and Caldwell's Facilities Plan will develop alternatives to solve Los Osos/Baywood Park water quality and public health problems.

Preliminary cost and user charge estimates should be available by the time of the Regional Board hearing. At this writing, it appears that costs for significant protection of groundwater will be relatively high. The Regional Board must decide if these costs are reasonable, considering all demands being and to be made on those waters. In project meetings, San Luis Obispo County representatives have indicated that the most significant source of nitrates is urban landscape fertilization. Regional Board staff calculations indicate this source constitutes only about 4% of the basins nitrogen load. The County's consultant (and Phase I report) agrees that about 85% of the nitrogen load is from sewage effluent. Secondly, some County representatives are of the opinion that the lower groundwater is a separate aquifer which is protected from shallow groundwater. This is also the conclusion of the Phase I report, although the potential for mixing is acknowledged. Regional and State Board staff disagree with this opinion based on examination of well logs. (Appendix H). Local residents and the Regional Board may not have the luxury of allowing continued degradation of shallow groundwater in the face of high project costs. Residents currently using shallow groundwater for drinking water could be supplied with an alternate source at a relatively low cost. This may be necessary on an interim basis even <u>with</u> a groundwater protection project. However, if the "confining beds" separating shallow and deep groundwater are as non-continuous as the well logs indicate, deeper groundwater will eventually degrade as has shallow groundwater. With this assumption, relatively high project costs become less important.

-No Project

Costs associated with the "no project alternative" include taxes paid for unbuildable empty lots (in those areas with septic system constraints which prohibit building), and unsuitability of shallow, and eventually, deep groundwater. This is the sole source of water supply for the area.

e. Need for Housing

A prohibition would elevate Los Osos/Baywood Park to a fundable priority, allow project construction, and remove sewage disposal pollution of Los Osos groundwater.

In the short term, a prohibition of additional discharges would be a severe hardship to potential homebuilders and potential new commercial establishments. If a project could not be funded through the grant project or other typical public works project financing means, this hardship would continue and the housing demand would increase.

f. Possible adverse impacts from continued discharges.

Problems already discussed would continue and become more severe.

g. Failure rates of any existing individual disposal systems whether due to inadequate design, construction, or maintenance, or unsuitable hydrogeologic conditions.

Failure rates and causes have already been discussed in this report. As a general rule, septic systems do not receive adequate maintenance. Many are not maintained or serviced until they fail. Therefore, pumping records could have been used as a means of evaluating failure rates. However, San Luis Obispo County does not have a record of septic tank pumpings. Regional Board staff requested the County to include a record of on-site system failures in the Phase I report. The initial response was that there were no failures in the area. This is in spite of failures discussed in earlier memos and letters (Appendices F and G). Following the heavy rains of 1983, the County prepared a report on drainage problems in Los Osos (Appendix H). This report indicates County involvement in flooding problems dates back to 1976. Of course, septic systems cannot function properly in flooded, saturated areas.

h. Evidence of existing, prior, or potential contamination.

This has already been discussed.

i. Existing and planned land use, dwelling density, and historical population growth.

Existing land use is described under "Community." The majority is residential. There is a planned change in land use for this area (Figure 4) as outlined under "Community." The projected maximum number of future dwelling units for Los Osos/Baywood Park is estimated to be 9,700 as opposed to the 1980 dwelling unit number of 4,368 with a corresponding population of 10,933. The ultimate population under current plans is estimated to be 24,300 people. This represents a 222% increase over the 1980 population.

VI. C. <u>CEQA Compliance</u>

An Environmental Checklist and Notice of Filing have been prepared and circulated by staff. This will satisfy California Environmental Quality Act (CEQA) requirements if approved by the Regional Board following the public hearing. These documents relate to the action of amending the Basin Plan, rather than any subsequent construction project.

VI. D. <u>Surface Water Protection</u>

This Basin Plan Amendment proposes a zone of prohibition along Los Osos Creek and Eto Creek and Lake (Figure 10). The prohibition will be a

zone one hundred feet on either side of the creek flow line. This criterion is based on the Basin Plan recommendation of one hundred foot setback from creeks. This recommendation was partially based on State Health Department criteria of a one hundred foot setback from wells to ensure a safe distance for bacteria and virus removal from septic tank effluent. This is considered to be a safe distance with suitable soils.

As of June, 1978, there were 9 parcels along Los Osos Creek having on-site disposal systems potentially within the prohibition zone. Along Eto Creek there were approximately 8 out of 17. The County's current land use map indicates there will ultimately be development all along Los Osos Creek, designated for residential suburban development. If this area is developed, there will be between 30 and 40 additional parcels affected by this prohibition zone. New discharges must be 100 feet away from creeks to comply with existing Basin Plan criteria. The prohibition would only affect those parcels having on-site disposal systems within the two hundred foot zone by July 1, 1987, to a site compatible with Basin Plan siting criteria.

VII. SUMMARY AND RECOMMENDATION

Los Osos/Baywood Park groundwater is being contaminated by septic tank/leachfield wastewater disposal systems. It is estimated these systems contribute 91% of the nitrogen going to groundwater from man-caused sources. This nitrogen contribution is leading to nitrate concentrations in groundwater which exceed State Health Drinking Water Standards, causing a hazard to public health. There are preliminary indications groundwater is also being contaminated by fecal coliform, with 60% of the wells tested showing Total Coliform in violation of State Health Drinking Water Standards. Areas of surfacing and high groundwater have been documented by both the County Health Department and County Engineering. County Engineering stated these areas are a potential public health threat and that a building moritorium should be established in these areas. Surface water sampling indicates total coliform in violation of Basin Plan limits for these waters. High nitrates, bacterial levels, and high groundwater present a public health hazard and "contamination" as defined in the California Water Code.

Water quality and public health problems within the Los Osos/Baywood Park Study area need to be solved. To accomplish this a discharge prohibition should be established. Discharges from existing and proposed on-site sewage disposal systems should be prohibited in the area designated in Figure 10. The description of the prohibition zones is included as Attachment A with Resolution 83-13. Draft Resolution 83-13 would amend the Water Quality Control Plan for the Central Coastal Basin to prohibit new discharges forthwith, and eliminate existing discharges by July 1, 1987.

The proposed prohibition area is based on consideration of:

1. areas with unacceptably high groundwater nitrate concentrations (Figure 7A),

SUMMARY OF COMPLAINTS MADE BY RESIDENTS TO THE SAN LUIS OBISPO COUNTY HEALTH DEPARTMENT
1981 - 1983

Date	Nature of Complaint & Location
February 17, 1981*	Surfacing effluent; foul odors.(1440 Block of 6th Street)
February 20, 1981	Toilet backed up into shower. (1200 Block of 2nd Street)
April 10, 1981	Surfacing effluent, flowing across road.
April 14, 1981	Septic system failure at laundromat, water standing in parking lot; foul odors. (10th & Los Osos Valley Road)
April 23, 1981*	Sewage ponding and running into gutter; causing mosquito problem. (Mt. View and Los Olivas)
May 4, 1981*	Sewage running down street; foul odors; mosquito problem. (2000 Block Mt. View)
June 12, 1981*	Water from septic tank backing up into residence. (1400 Block of 8th Street)
June 17, 1981	Foul odors emanating from shopping center septic system. (1000 Block of Los Osos Valley Road)
June 26, 1981*	Failing septic system, backing up into residence planter boxes. (1200 Block of Santa Ynez)
July 1, 1981*	Sewage ponding on ground and running into neighbor's yard. (500 Block of Woodland Drive)
July 13, 1981	Foul odors emanating from Shopping Center.
August 28, 1981*	Greywater-grease trap system failure. Sewage running from system onto the street. (400 Block of Lilac Street)
October 8, 1981*	Septic system backing up and water standing on ground and driveway; foul odors. (700 Block of Los Osos Valley Road)
December 31, 1981*	Septic system failure; sewage ponding. (400 Block of Mar Vista)
September 20, 1982	Foul odors. (1400 Block of 6th Street)
April 1, 1983*	Sewage overflowing from septic tank. (1500 Block of 17th Street)
April 12, 1983*	Drainage problem at MHP. (1500 Block of Los Osos Valley Road)

*Plotted on Figure 9 Map

APPENDIX D

Date	Nature of Complaint & Location
April 26, 1983	Foul odors emanating from Shopping Center.
May 4, 1983*	Failing septage system, overflowing onto neighboring lots. (18th and Paso Robles Avenue)
May 9, 1983	Sewage backing up into apartments. New leach field was to be put in. (1200 Block at Los Olivas)
May 25, 1983*	Septage water from residence running between two adjoining lots. Foul odors. (1500 Block of 18th Stree)
May 26, 1983*	" " " "
June 2, 1983*	Sewage from flushed toilets bubbles up and ponds near driveway entrance. Slime buildup. Children play in water. (1300 Block of Los Olivas Avenue)
June 9, 1983	Sewer water running off property onto street. (2000 Block of Mt. View)
July 1, 1983	Neighbor was using greywater to irrigate his yard. (1100 Block of 9th Street)

COUNTY OF SAN LUIS OBISPO · 2191 JOHNSON AVENUE · SAN LUIS OBISPO, CALIFORNIA

H. HOWARD KUSUMOTO, M.D., M.P.H.
HEALTH OFFICER

☐ 2191 JOHNSON AVENUE
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P.O. BOX 1459 543-1200

☐ 225 SO. 16TH STREET
GROVER CITY CALIF. 93433
P.O. BOX 425 489-4722

☐ VETERANS MEMORIAL BUILDING
PASO ROBLES, CALIF. 93446
P.O. BOX 155 238-1880

☐ 200 EAST DANA STREET
NIPOMO, CALIF. 93444
P.O. BOX 445 929-3277

☐ VETERANS MEMORIAL BLDG.
ATASCADERO, CALIF. 93422
P.O. BOX 813 466-3000

MEMORANDUM

April 27, 1976

TO: Supervisor M. E. Willeford

FROM: Tim Mazzacano, R.S., Environmental Health

SUBJECT: Septic System Failures, Cuesta-By-The-Sea

Upon receipt of your memorandum, dated March 30, 1976, the Division of Environmental Health contacted Mr. & Mrs. Gewynn Taylor regarding the allegations made in her recent correspondence to you.

A meeting was held the morning of April 16, 1976, with the Taylors, at which time Mr. Michael Doherty and myself requested additional information to support the allegations made in her March 17, 1976, letter to you.

On April 20, 1976, a septic system survey was conducted in the Cuesta-By-The-Sea area by Environmental Health staff. In this regard, the survey was restricted to those residents delineated on a list provided us by the Taylors.

This Department's standard "Sanitary Survey" questionnaire was employed (see attached copy).

The following is an abstraction of the results of that survey:

460 Mitchell Road; Owner/Occupant L. Balthaser; Systems repaired in 1972; seasonal failures until that time; home twenty years old, [illegible]

433 Binscarth Road; Owner/Occupant V. Wright; System repaired in 1975; repeated failures until repaired. Home five and half years old.

429 Biscarth Road; Owner/Occupant T. Semonsen; System repaired in last five months; seasonal failures until repaired; home in excess of forty years old. [illegible]

453 Binscarth Road; New home; construction not completed. Alleged to have septic system under foundation. [illegible]

1910 Pine Avenue; Owner/Occupant P. Wood; System repaired in last year; seasonal failures prior to Wood occupancy. Home less than four years old. [illegible]

1850 Donna Avenue; Owner L. Campbell; System repaired in 1975; repeated failures until repair; Home six years old,

1853 Donna Avenue - No such address ? [illegible]

462 Mitchell Drive - No such address

1744 Donna Avenue; Owner/Occupant Kype; No repair to the system; one failure recently; home three years old. [illegible] failure, why no repair?

362 Binscarth Road; No one home during survey. Left card requesting they call Health Department regarding survey. [illegible] 1960 [illegible]

1786 Binscarth Road - No such address

542 Binscarth Road - No such address - Vacant lot

811 Pine Avenue - No one home during survey; left card requesting they call Health Department regarding survey. [illegible] old church parsonage. [illegible] pumped for first time 3 months ago.

307 Binscarth - Incorrect address or no such address; Home under construction at 309 Binscarth. Alleged [illegible] - owner & inspector [illegible] "no".

1786 Fern Avenue; Owner/Occupant Weir; System repaired one week ago; repeated failures since March of 1975; Home four years old. House planned for front yard septic, but system was installed in rear - failed due to improper installation - has now been relocated to front yard.

Corner Fern and Lupin (sic) - New Home under construction. Ostensibly little or no area for septic system of adequate size. System inspected by engineering firm as well as by county. Has proper dimensions.

437 Binscarth Road; Home under construction - [illegible]

1811 Fern Avenue; Owner/Occupant; No repair or failure to/by system.

In addition to those alleged failures delineated in Mr. & Mrs. Taylor's list, the following residences where referred to us as failures:

1851 Fern Avenue; Owner/Occupant Cadwell; System repaired within last six months; repeated failures until repair; home ten years old.

1871 Donna Avenue; Owner/occupant; No repair to system, however, frequent pumpings required to keep system "safe"; repeated failures; age of home unknown. - by neighbors)

464 Mitchell Drive; Owner/occupant Clark; System repaired less than a year ago; repeated failures; age of home unknown. 6 people in family, plus mother-in-law, [illegible] home 6 yrs old.

At this time, this Department does not have adequate material or empirical evidence to substantiate or refute Mrs. Taylor's allegations. However, the scope and degree of failures in this area is alarming; as indicated by this abbreviated survey. In this regard, there are at least three possible "causes", which may individually or collectively precipitate septic system failures:

(1) Inadequate percolation test, either poorly managed or supervised.

(2) Inadequate, poorly installed and sub-sized septic systems relative to the size home constructed.

(3) Inadequate supervision, relative to items (1) and (2) by the responsible governmental agency.

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[illegible] area of the survey [illegible]. The most salient comment or allegation reiterated during the survey by most of the residents, was that the current standards for septic systems are either inadequate or are not adequately enforced (the latter being particularly emphasized).

Regarding Mrs. Taylor's suggestions (1-5, Page 2), this Department lacks engineering expertise. Obviously, it would be advantageous to require engineered septic systems, however, such a requirement should be considered in the light of costs to the County.

Relative to stricter adherence to County Ordinances and stricter supervision of the actual construction phase, such a suggestion warrents serious consideration.

H. HOWARD KUSUMOTO, M.D.
Health Agency Director

TIM MAZZACANO, R.S., Director
Division of Environmental Health

HHK/RRJ/TM:bh

October 8, 1975

The undersigned residents of Cuesta-by-the-Sea certify that they have NOT experienced septic tank failures.

NAME	ADDRESS
Mr. & Mrs. Robert Williams	HERE 11 YEARS 409 Rancheria Ave Cuesta by the Sea
Mr. & Mrs. Hugh Stokes	1871 Dorado Ave (Cuesta by the Sea)
Mr. & Mrs. Bruce Cliffe	Live here 10 years 1921 Fresno St. Los Osos
Mr. & Mrs. Arthur M. Kreiter	1924 Fresno Ave Los Osos Ca.
David R. Tracey	424 Mitchell Dr. Los Osos,
74-051-23 74-051-05 Mr. & Mrs. Jack Kim Smith	374 Mitchell Dr. Cuesta Los Osos
Hamilton A. Smith	374 Mitchell Dr. Cuesta by the Sea Los Osos Ca.
Mr. & Mrs. Jim McCue	380 Mitchell Drive
74-156-34 Mr. & Mrs. Victor Matson	496 Binscarth Rd. Los Osos
[illegible]	851 [illegible]
Robert A. Cosentino	1811 Doris Ave Cuesta by the Sea
Harry G. Cobb	Lived here 10 years 1874 Henrietta Cuesta by the Sea
Conrad Rothenberg	1881 Dorado Ave. Los Osos
Alonzo Marquez	1860 Dorado Ave. Los Osos
Mary Lemon	1861 Doris Cuesta by the Sea
Jane [illegible]	1[illegible] Doris Ave

009390

October 8, 1975

The undersigned residents of Cuesta-by-the-Sea certify that they have NOT experienced septic tank failures.

NAME	ADDRESS
[illegible]	1818 [illegible] Cuesta Byth Sea 1890
E.C. Bopp	[illegible] Doris St Cuesta By the Sea
Dorr Johnson	1871 Doris St. Cuesta By the Sea
Dorian E. Olsen 74-161-21 74-363-04 -152-06 -232-30 -[illegible]-13 445-01 392-07 271-07	1900 Block of Cuesta By the Sea

009391

DEPARTMENT OF PUBLIC HEALTH

2191 Johnson Avenue • P.O. Box 1489 • San Luis Obispo, California 93406
COUNTY OF SAN LUIS OBISPO

[X] 2191 Johnson Avenue
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P.O. Box 1489 • ~~549-5550~~ 549-5544

[ ] Veterans Memorial Building
Paso Robles, Calif. 93446
P.O. Box 155 • 238-1880

[ ] 5575 Capistrano Avenue
Atascadero, Calif. 93422
P.O. Box 813 • 466-3000

[ ] 238 So. 16th Street
Grover City, Calif. 93433
P.O. Box 425 • 489-4722

[ ] 200 East Dana Street
Nipomo, Calif. 93444
P.O. Box 445 • 929-3277

[ ] Home Health Agency
1160 Marsh — Suite Z-2
San Luis Obispo, Calif. 93408
549 5754

• HOWARD W. MITCHELL, M.D., M.P.H.
Health Officer

December 4, 1980

California State Coastal Commission
631 Howard Street
San Francisco, California 94105

Attention: Lisa Vittori

Re: San Luis Obispo County-Los Osos, Cuesta By The Sea Tract

On Wednesday November 26, 1980 a telephone call was received from your office requesting this Department to comment on sewage disposal conditions for the above referenced tract.

This office does not issue sewage disposal system permits on existing lots of record, however, we do receive complaints and are generally aware of various local ground water conditions within the County including Cuesta By The Sea, Los Osos.

A seasonable sewage disposal problem has been noted at the lower lying areas near the bay along Binscarth Street between Pecho and Pine and northerly. State Water Resources groundwater elevation maps, 1979, Exhibit "A", show static groundwater at five (5) feet and in some cases possibly less. Generally, problems with backed up septic systems or sluggish fixtures have been due to groundwater fluxuations effecting seepage pits or leachfields during periods of heavy or prolonged rains. In addition, drainage is poor and as build out density increases, i.e. increased street paving, structure foundations, driveways, etc. sheet drainage is increasingly channeled downhill towards the bay, southwest, east and the northerly part of Cuesta By The Sea as well as similar areas of Baywood Park. This combination of channeled drainage, much of which will rapidly percolate into the permeable sands in low lying areas along Binscarth and northerly cross streets before reaching the bay, and the sewage disposal systems in such close contact on small lots, most of which are 40'x100', will cause premature failure of waste water disposal.

The following list of parcels have in the past had a generally seasonal septic wastewater disposal problem for this area, see attached map, Exhibit "C". This is by no means a complete picture and was determined by spot check random interview, observation, complaint or past history and may not represent a majority or minority of cases. A complete analysis would require a 100% contact on site, door to door survey of all residents, especially after several months of heavy rains.

APPENDIX F

009396

PARCEL NUMBER	COMMENTS
74-133-27	Temporary inoperable disposal area after heavy rains. Backup of groundwater into the septic tank.
74-133-28	Replaced leachfield with a seepage pit early 1980 after heavy rains. Septic tank had to be pumped repeatedly.
74-133-17	Additional seepage pit added in rear yard after the front yard area failed. Replacement done sometime in 1979
74-132-28	Early 1980, replaced disposal field with seepage pit after heavy rains.
74-136-34	Replaced original seepage pit with a new leachfield three (3) years ago. Home is eight (8) years old.
74-135-27	Sewage disposal area presently failing with surfacing effluent in the yard along Binscarth.
74-145-3	Sluggish fixture noted by renter during periods of heavy rain. Two homes are on one lot, 40'x120'. Two homes are on one septic system. Repairs and or pumping was done fairly recently according to tenant. Homes are probably greater than ten (10) years old.
74-144-8	Disposal field repaired or replaced sometime in late 1979 or early 1980.

It should be noted some sewage failures can occur due to lack of proper maintenance or large family overloading of the systems. Some have bypassed washing machine graywater by surface discharge or separate gravel pit to reduce septic tank loading problems. Occasionally rentals will have a higher failure rate than home owners, especially those familiar with septic systems and the area. Often contractor built homes for sale will only provide the minimum required size disposal systems while owner-builders will instal a much larger disposal system, possibly with a mechanically alternating leachfield. In most cases, in the lower areas observed, the seasonal shallow groundwater seems to be the problem rather than poor soils due to the excellent percolation qualities (generall five (5) minutes per inch) of sand. Homes on the higher elevations have a much higher separation and do not experience groundwater problems for the most part.

In regards to chemical quality, a recent report conducted by the State Water Resources Control Board in 1979 indicated four (4) wells in the Cuesta By The Sea area (Los Osos Basin) with nitrate levels at or in excess of 45 mg/l, Exhibit "B". Forty-five mg/l is a maximum contaminant level for community domestic use water and is an indicator of sewage and or fertilizer contamination to groundwaters. Most of the wells sampled through out the Los Osos Basin with high nitrates have been relatively shallow private wells. We have enclosed some literature on nitrates which you may find informative.

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For further information regarding the area we suggest you contact Mr. Richard J. Zipp, Associate Engineering Geologist, Division of Planning and Research, State Water Resources Control Board who conducted the 1979 Geohydrology and Water Quality Baywood-Los Osos Groundwater Basin Report and our Regional Water Quality Control Board.

TIM MAZZACANO, R.S., Director
Division of Environmental Health

GERALD E. ERICKSON, R.S.
Deputy Health Officer III
Water-Land Use Section

TM/GEE:cs
Enclosure

009398

5. Between the Third Street/Pismo Avenue intersection and the South Bay Boulevard/Santa Ysabel Avenue intersection (see Section D-D', area between the Section B-B' intersection and well 8M2).

Conclusions

Based on the data available, the upper and lower aquifer zones are not effectively separated throughout the Baywood-Los Osos area.

1. A clay layer cannot be proven in many areas because of a lack of deep well information;

2. Well logs indicate a lack of clay in some areas;

3. The varying elevations and lithology of clay layers in different parts of the Baywood/Los Osos area indicates that the clay may not be the same unit and therefore may not be continuous; and

4. Even in areas where relatively continuous clays are known to be present, the vertical migration of poor-quality water can take place through multi-perforated wells or abandoned, unsealed deep wells.

In many cases, I believe that the clays indicated on the section do not represent the top of the Paso Robles Formation. In some locations, they represent a clay layer within the old dune sand, while in other locations they represent the top unit in the Paso Robles Formation. This confusion could be reduced with additional deep well log data.

Charlene Herbst

Charlene Herbst
Assistant Engineering Geologist
Hydrogeology Section

Attachments:
(1) Map Showing Location of Geologic Sections and Wells
(2) Section A-A' (2 sheets)
(3) Section B-B' (2 sheets)
(4) Section C-C' (2 sheets)
(5) Section D-D' (2 sheets)
(6) Other Deep Wells Located on Attachment (1)
(7) Overlay Showing Areas Underlain or Not Underlain by Clay, or Lacking Data

A subdrainage system would be extremely expensive for the number of properties benefiting in the 16th - Paso Robles and 8th - El Moro areas. Again, if sewering occurs, the problems will be solved. If not, then pressure-mound systems installed by the affected property owners would be in order.

With respect to the high groundwater problems, we recommend that the County not initiate any action at this time. If the area is sewered as a clean water grant project, the problem will be solved. We should know in a few months if this is the recommended plan. (Brown and Caldwell, Consulting Engineers are now completing a water quality investigation of the Los Osos area. Following that will be a Facilities Plan with a recommended solution.) If Mother Nature does not solve the problem with an average or dry weather cycle, then the County should initiate steps requiring affected property owners to provide interim or permanent pressure-mound systems to take care of their septic tank effluent during the periods of high groundwater levels.

2. Surface Drainage

Because we have been unsuccessful since 1976 in obtaining community support for creating assessment districts to solve the surface drainage problems, we now, reluctantly recommend that the Board change its policy for this problem only and initiate assessment districts for four areas:

16th Street - Paso Robles Avenue
8th Street - El Moro Avenue
Los Olivos
Don - Mitchell

This would require a budget adjustment to provide the necessary front money. A project for the erosion problems below Cabrillo Estates has been included in the zone of benefit budget (CSA No. 9-D) and such is now being designed.

The remaining areas are generally small ponds (bird baths) on road rights of way and can be largely solved by roadside grading. Such will be done as a part of the routine roadside maintenance.

A more careful review of the problem areas is necessary and may require additional funding.

Morro Bay National Estuary Program's Implementation Effectiveness Program For the Morro Bay Watershed

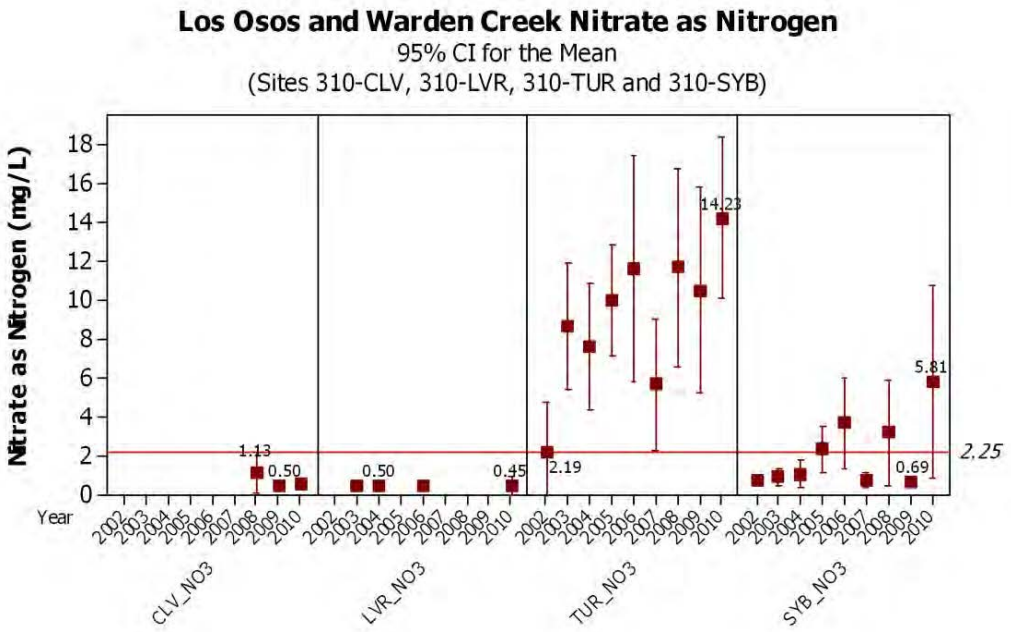
Data Summary Report 2010

Agreement Number
06-350-553-1
Tasks 8.5 and 10.7

Submitted by
Ann Kitajima, Program Manager
September 30, 2010

Morro Bay National Estuary Program
601 Embarcadero, Suite 11
Morro Bay, CA 93442

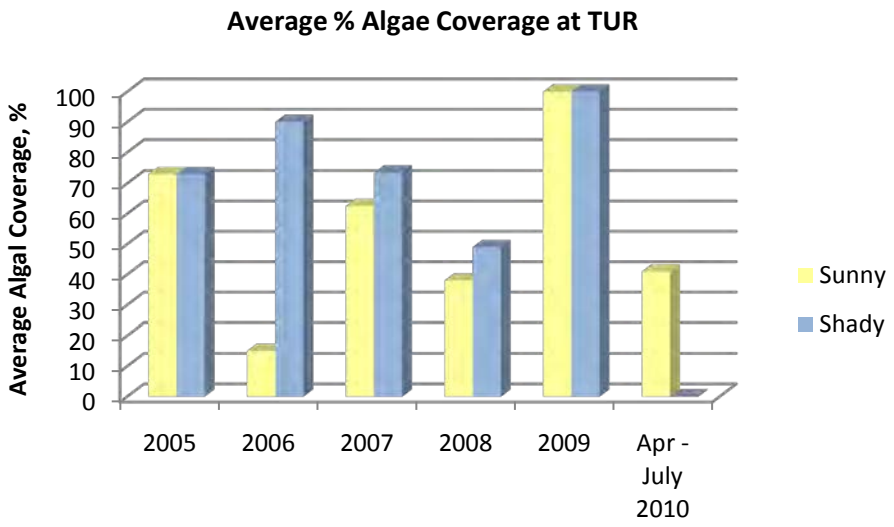
Funding for this project has been provided in full or in part through an agreement with the State Water Resources Control Board. The contents of this document do not necessarily reflect the views and policies of the State Water Resources Control Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. (Gov. Code, § 7550, 40 CFR § 31.20.)

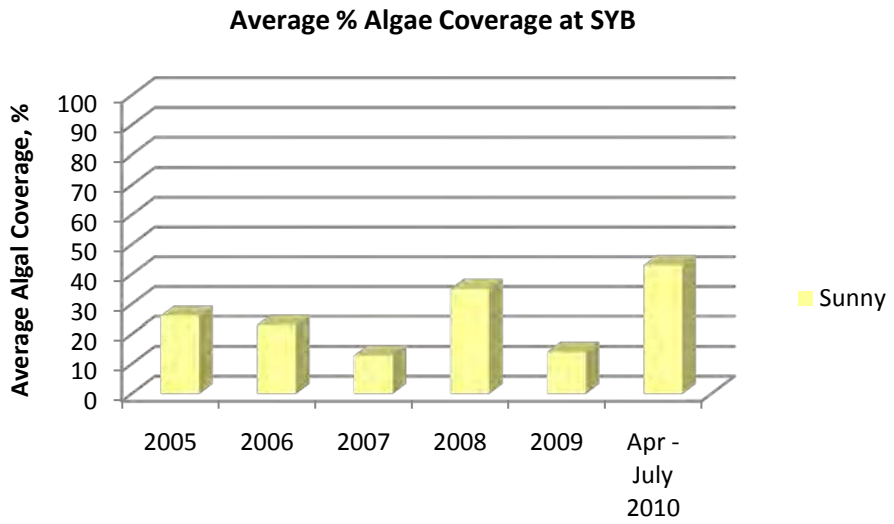


ALGAE DOCUMENTING

From April to October, volunteers collected data at eight established algae documenting sites. At each site, measurements are taken at a sunny location and a shady location. An algal percent coverage and observations of the types of algae are recorded. The canopy coverage is estimated using a densiometer. The CCRWQCB utilizes the data in assessing 303(d) listings and de-listings, as well as TMDL implementation effectiveness. The informal criteria for a nuisance bloom is greater than 40% coverage of algae. Algae documenting sites have been established on Warden Creek on Turri Road near Los Osos Valley Road (TUR) and on Los Osos Creek on Turri Road near South Bay Boulevard (SYB).

The following graphs show the average of the percent of algal coverage at each of the sites at the sunny location and average percent algal coverage at the shady location. The site on Los Osos Creek (SYB) is complete bare of overhead canopy and thus does not have a shady site for comparison. While SYB appears to have lower percent coverage of algae than other sites, this was not likely the case. The high turbidity and tidal influence at the site made observation of algae challenging. The algal coverage at TUR appears to be as high or higher in the shady site than the sunny site, which may be related to the elevated nitrate levels that were often detected in the water.





The next graph shows the average percent of canopy coverage at TUR, in both the sunny and shady locations, from year to year. SYB has no canopy coverage so a shady location is not available for comparison. In 2010, changes in vegetation at TUR eliminated the historic shady location. The new shady location appears to be fairly different than the historic shady location, and site selection may need to be re-considered at that site in future years.

Although *Enterococcus* spp. is the preferred indicator for monitoring recreational contact safety in marine waters, the state of California continues to regulate shellfish growing waters using the fecal coliform indicator. In order to generate data comparable to the regulatory standards for fecal coliform, we continue to test for *E. coli* as well as *Enterococcus* spp. in the bay. The regulatory criteria for comparison are the recommended standards in EPA's 1986 guidance document *Ambient Water Quality Criteria for Bacteria*. For *E. coli* for a single grab sample, the water is considered to have an acceptable risk for swimming (REC-1 contact) if the concentration is below 235 MPN/100 mL in freshwater. Because no criteria exist for *E. coli* in marine waters, we've adapted the freshwater criteria for comparison. For *Enterococcus* spp., the EPA guidance cites 104 MPN/100 mL from a single grab sample in marine waters as safe for recreational contact (REC-1).

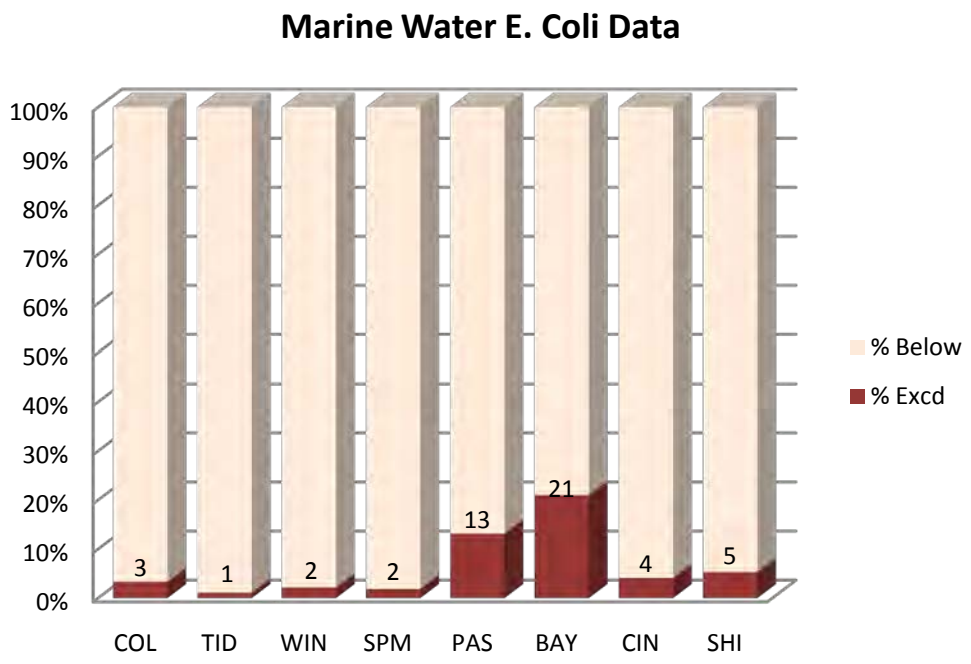
Based on typical sample dilutions, the range of detection for the *E. coli* and *Enterococcus* spp. testing is from < 10 MPN/100 mL to 24,196 MPN/100 mL.

E. COLI DATA

The following table contains the number of *E. coli* samples collected each year at the sites.

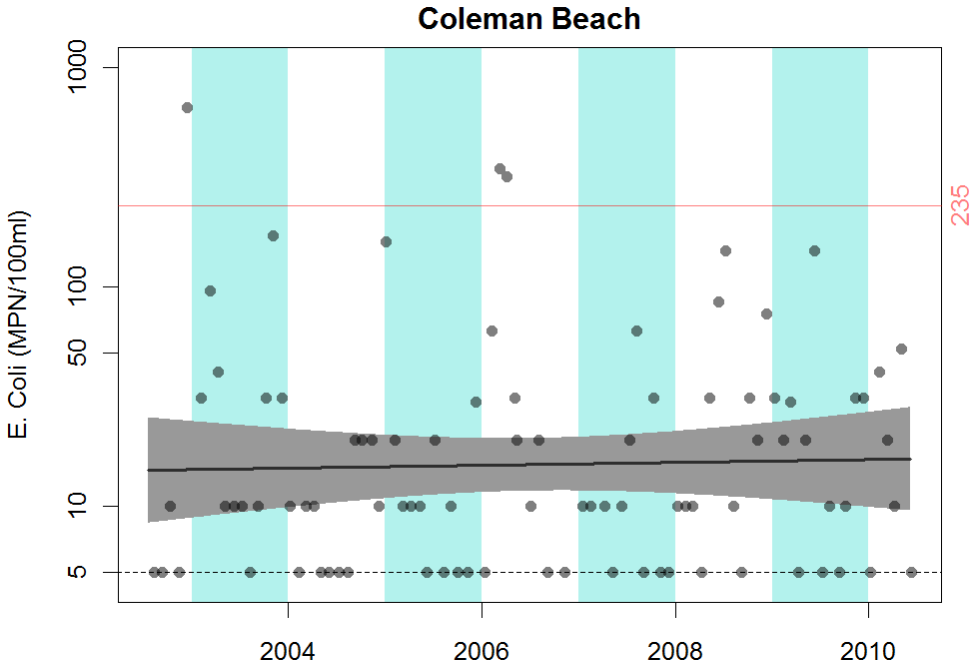
Site Code	Monitoring Start Date	Latest Monitoring Date	Number of Samples (n)	Number of Exceedances	Percent of Samples Exceeding
COL	July 2002	June 2010	91	3	3%
TID	July 2002	June 2010	92	1	1%
WIN	January 2004	June 2010	93	2	2%
SPM	July 2002	June 2010	109	2	2%
PAS	July 2002	June 2010	98	13	13%
BAY	July 2002	June 2010	92	19	21%
CIN	July 2002	June 2010	97	4	4%
SHI	December 2004	June 2010	37	2	5%

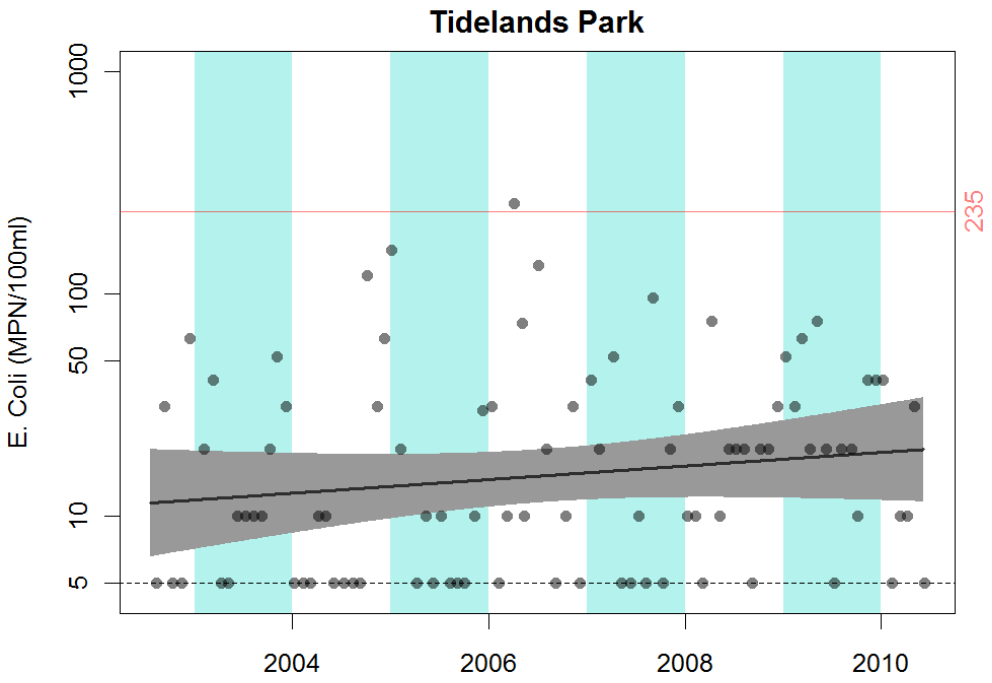
The following graph shows the % of samples that exceeded the 235 MPN/100 mL *E. coli* regulatory standard for safe recreational contact that was adapted from EPA's criteria in freshwater.

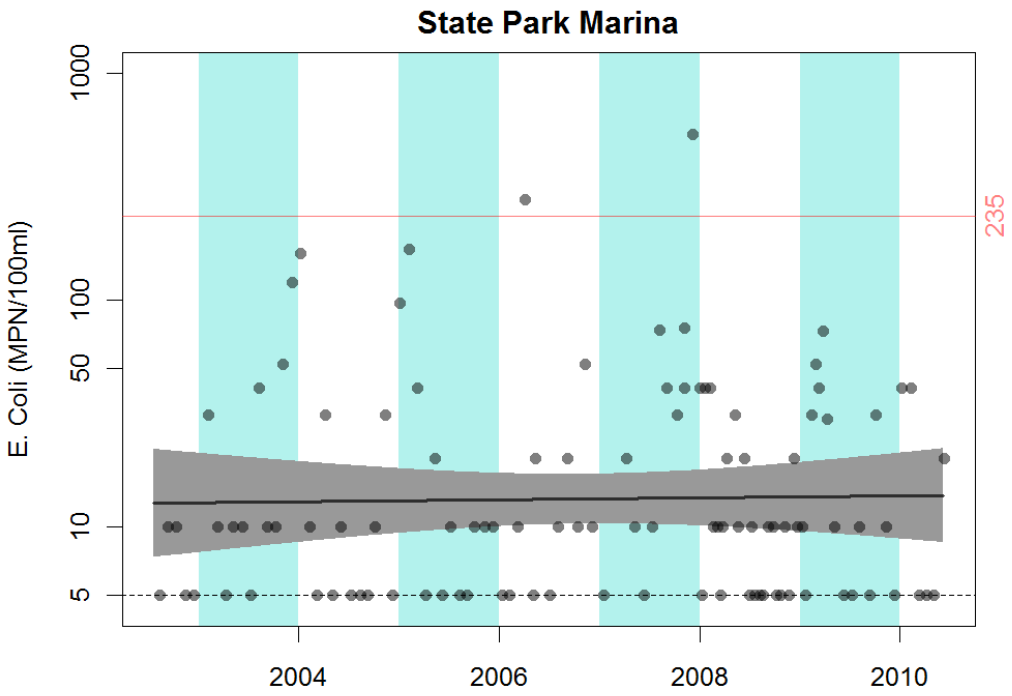


A statistical analysis was conducted to track the long-term trends of the bacteria data, rather than the year-to-year fluctuations. The black line on the plot shows the geomean of the *E. coli* concentration over time using smoothing splines. The gray band indicates the error band for the geomean, meaning the "true" geomean could be anywhere within the band. The higher the variability in the data, the wider the error band. Where more data was available for analysis, the error band is narrower. The up arrows indicate individual data records that exceeded 1,000 MPN/100 mL.

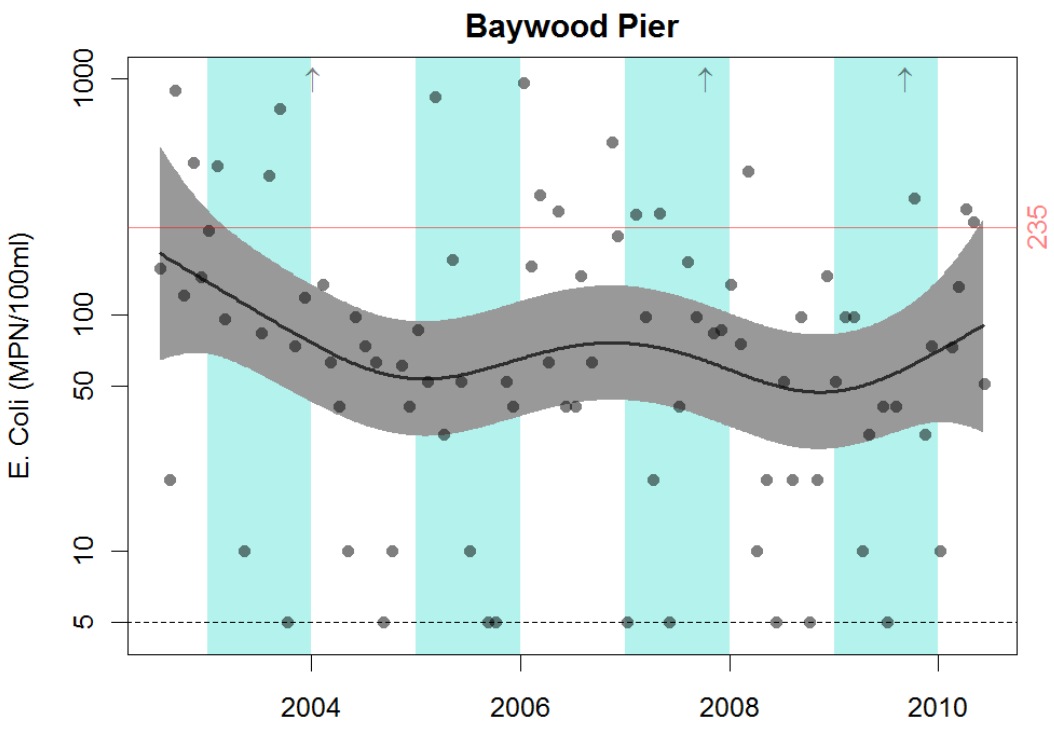
The first three plots are for the sites located toward the north end of the bay: Coleman Beach, Tidelands Park and State Park Marina. For all three sites, the long-term trend and the error band are well below 235 MPN/100 mL.

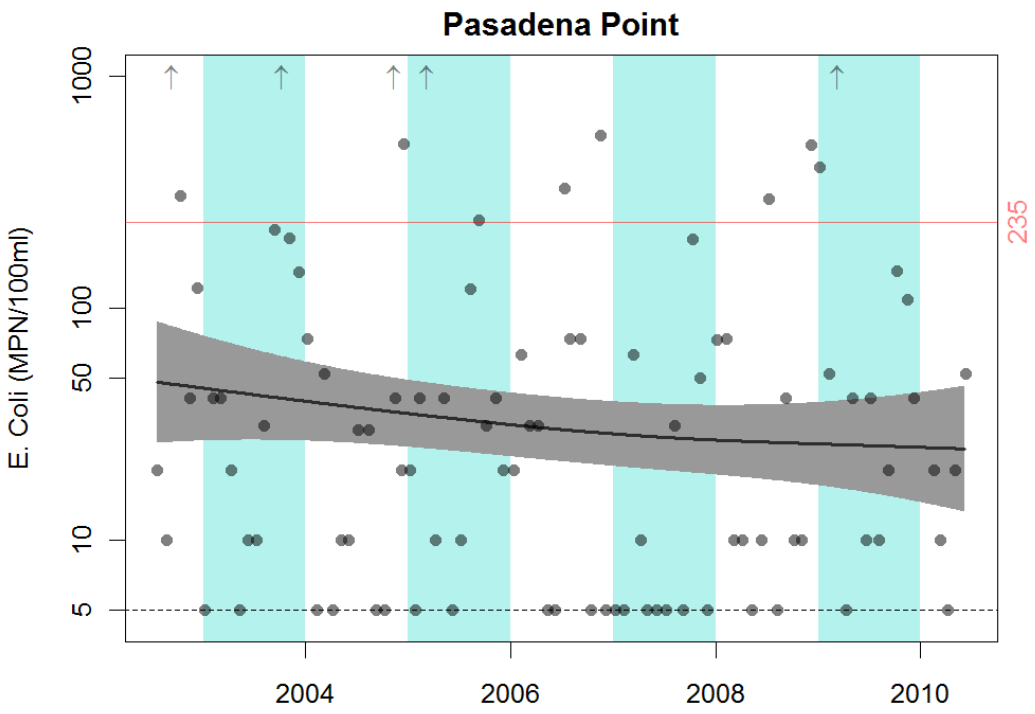


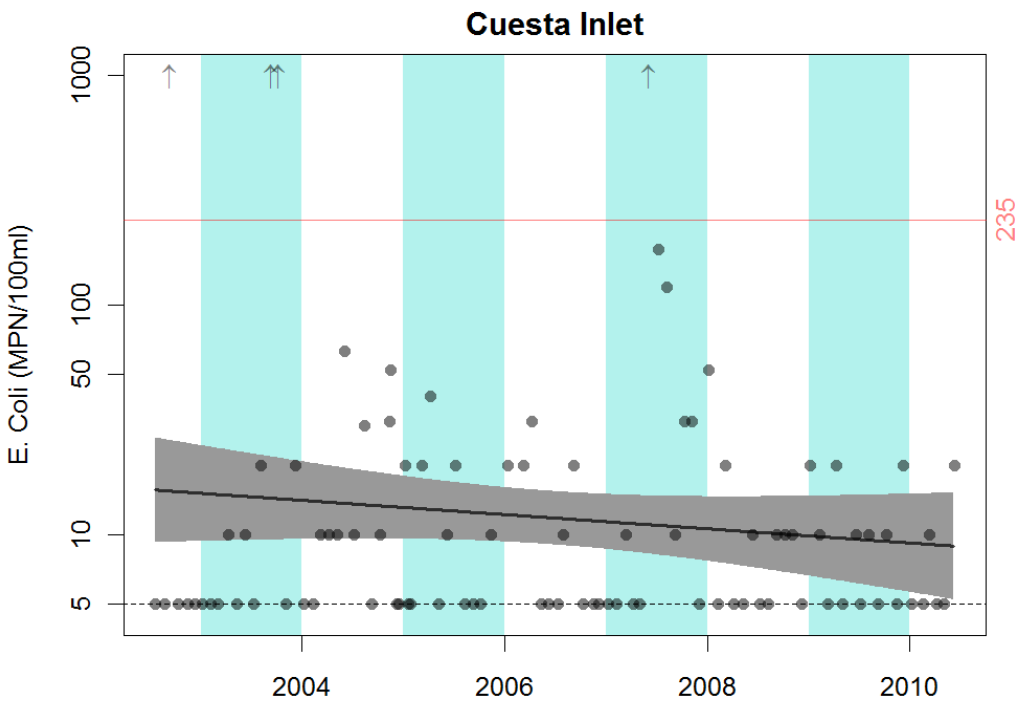




The following three plots are for monitoring sites toward the south of the bay, referred to as the back bay: Baywood Pier, Pasadena Point and Cuesta Inlet. Baywood Pier and Pasadena Point have *E. coli* trend lines that are elevated as compared to the sites in the front bay and to Cuesta Inlet in the back bay. Due to limited data, Sharks Inlet is not included in these analyses.


Baywood Pier
E. Coli (MPN/100ml)
1000
100
50
10
5
235
2004
2006
2008
2010


Pasadena Point
E. Coli (MPN/100ml)
1000
100
50
10
5
235
2004
2006
2008
2010

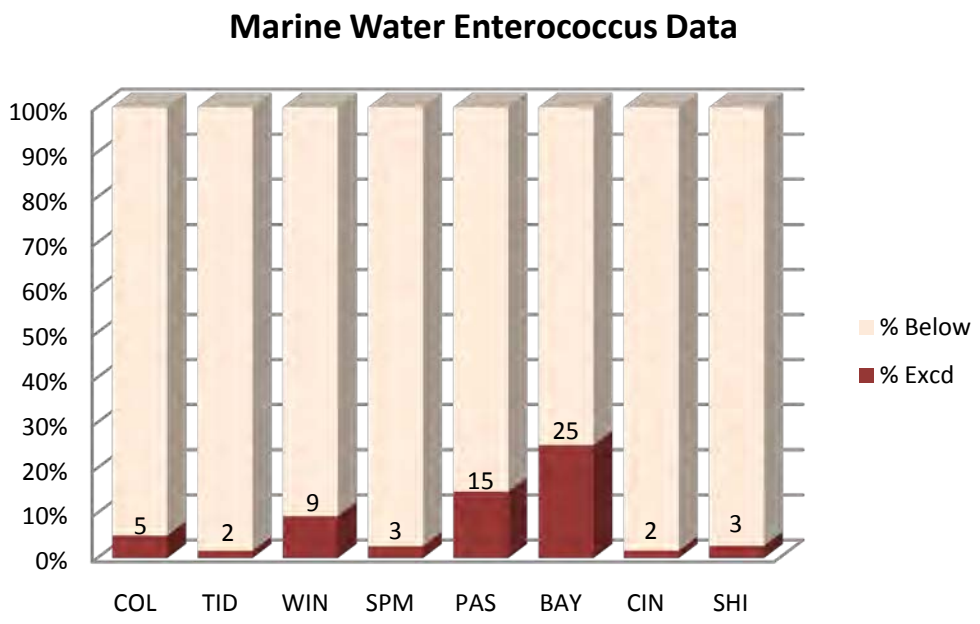


ENTEROCOCCUS SPP. DATA

The following table contains the number of *Enterococcus* spp. samples collected at the sites.

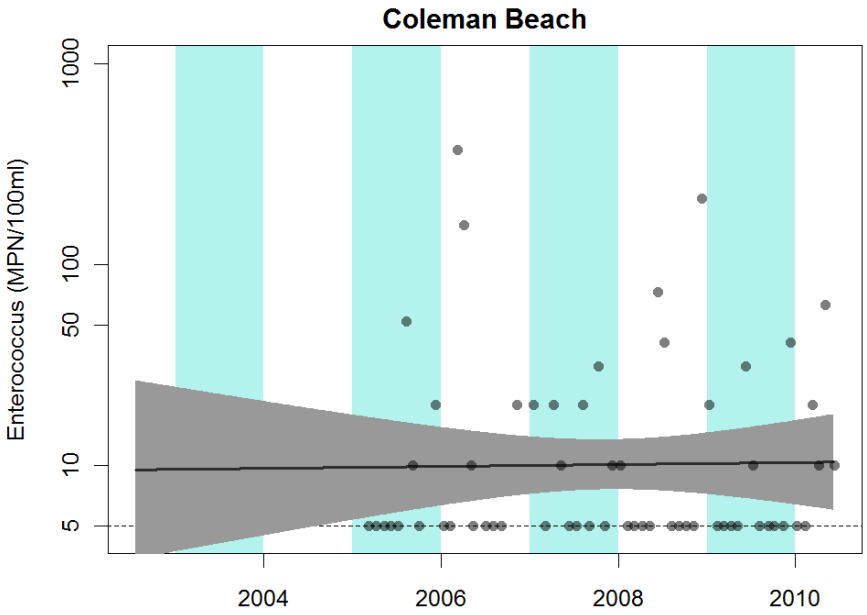
Site Code	Monitoring Start Date	Latest Monitoring Date	Number of Samples (n)	Number of Exceedances	Percent of Samples Exceeding
COL	March 2005	June 2010	60	3	5%
TID	March 2005	June 2010	62	1	2%
WIN	March 2005	June 2010	75	7	9%
SPM	March 2005	June 2010	77	2	3%
PAS	March 2005	June 2010	60	9	15%
BAY	March 2005	June 2010	60	15	25%
CIN	March 2005	June 2010	60	1	2%
SHI	July 2005	June 2010	36	1	3%

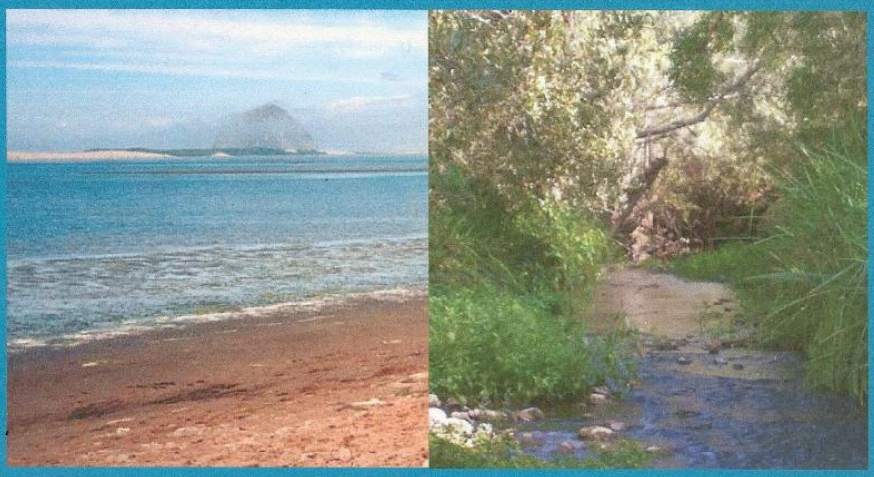
The following graph shows the % of samples that exceeded the 104 MPN/100 mL regulatory standard for safe recreational contact for *Enterococcus* spp.



A statistical analysis was conducted to track the long-term trends of the bacteria data, rather than the year-to-year fluctuations. The black line on the plot shows the geomean of the *Enterococcus* spp. concentration over time using smoothing splines. The gray band indicates the error band for the geomean, meaning the "true" geomean could be anywhere within the band. The higher the variability in the data, the wider the error band. Where more data was available for analysis, the error band is narrower. The wide error bands prior to 2005 are due to a lack of data. The up arrows represent individual data records that exceeded 1,000 MPN/100 mL.

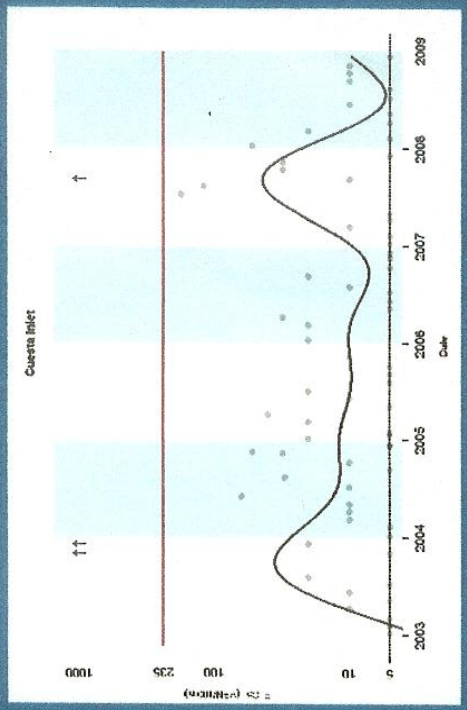
The first three plots are for the sites located toward the north end of the bay: Coleman Beach, Tidelands Park and State Park Marina. For all three sites, the long-term trend and the error band are well below 104 MPN/100 mL.



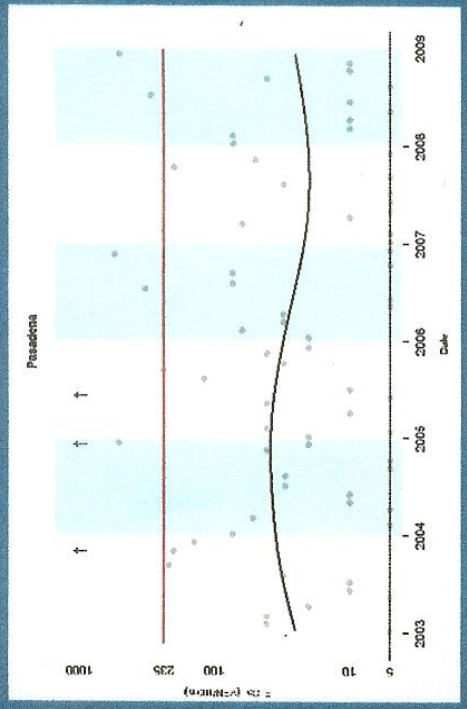


Data Share: Bacteria

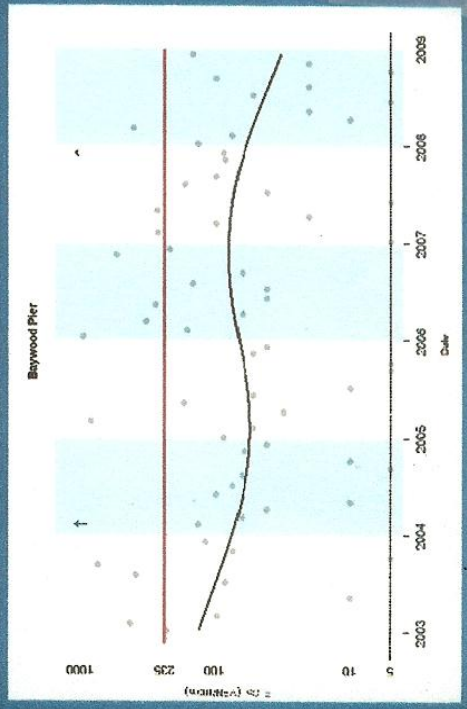
Morro Bay National Estuary Program
Volunteer Monitoring Program
September 15, 2009



Cuesta Inlet (CIN)



Pasadena Point (PAS)

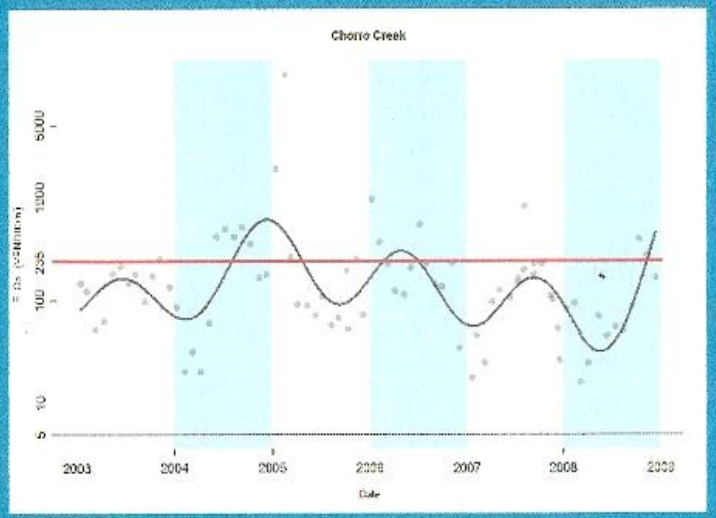


Baywood Pier (BAY)

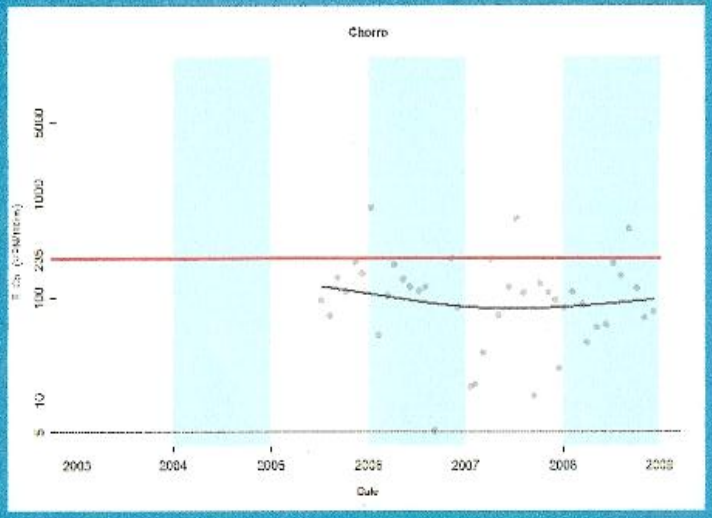
Tests at sites near Los Osos show bacteria (E. Coli) counts below safe limits

From the Morro Bay National Estuary Program (MBNEP)
Voluntary Monitoring Program (VMP) "Data Share: Bacteria"
September 15, 2009 http://www.mbnep.org/volunteer/summaries.php

C12
7-14



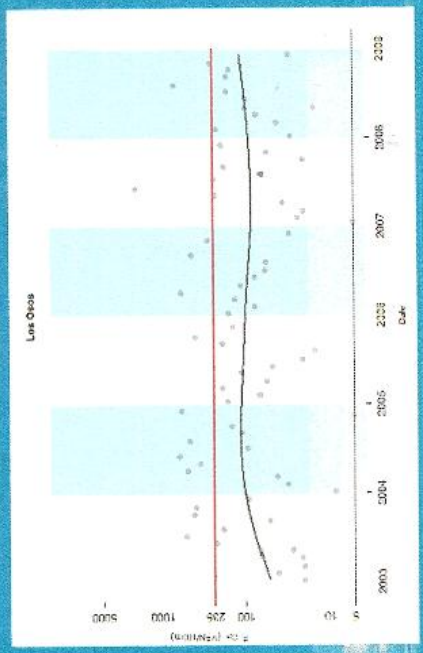
Chorro Creek at Canet Rd. (CAN)



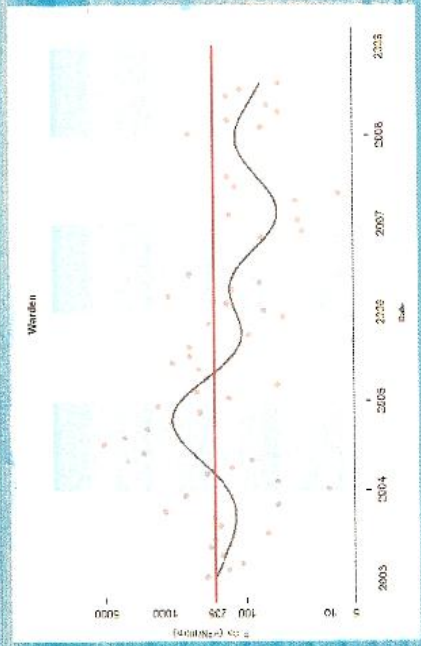
Chorro Creek at Twin Bridges (TWB)

Bacteria levels in creeks that enter the estuary are higher than at sites near Los Osos (also see next page).

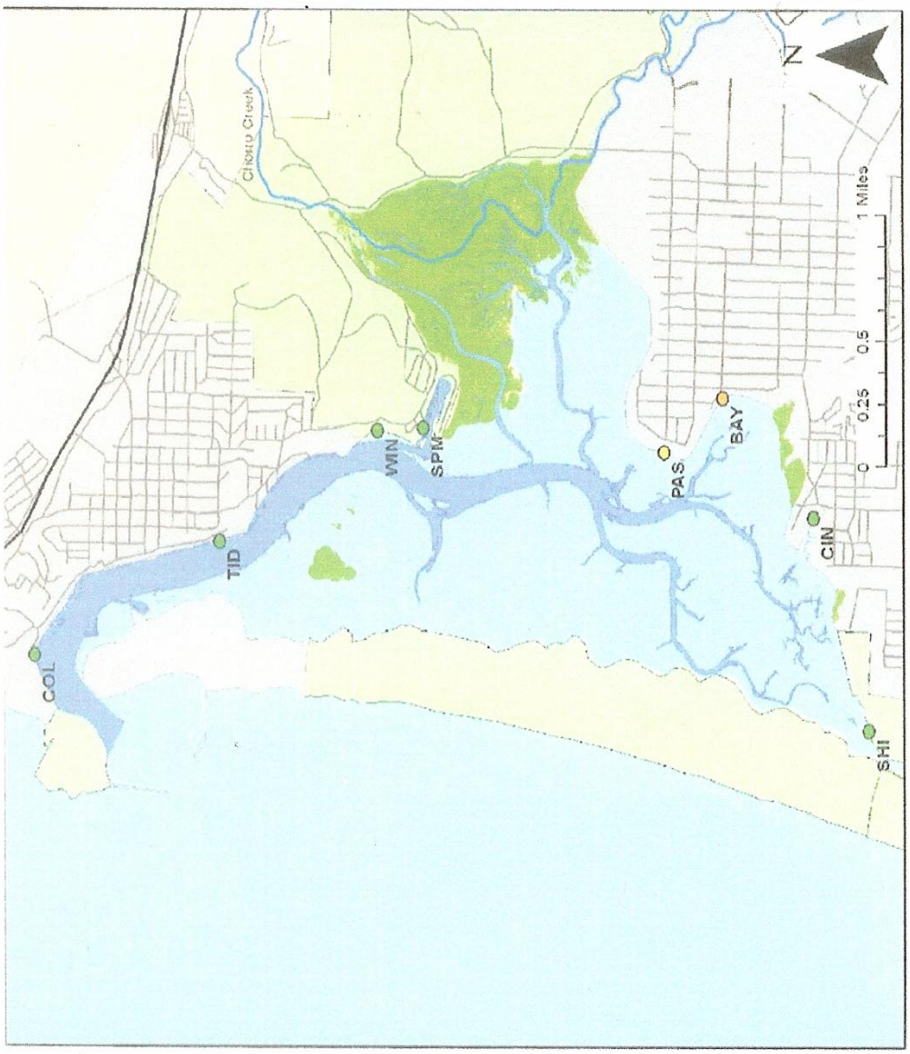
E. coli counts are higher in Los Osos Creek than at sites near Los Osos.



Los Osos Creek (SYB)



Warden Creek (TUR)

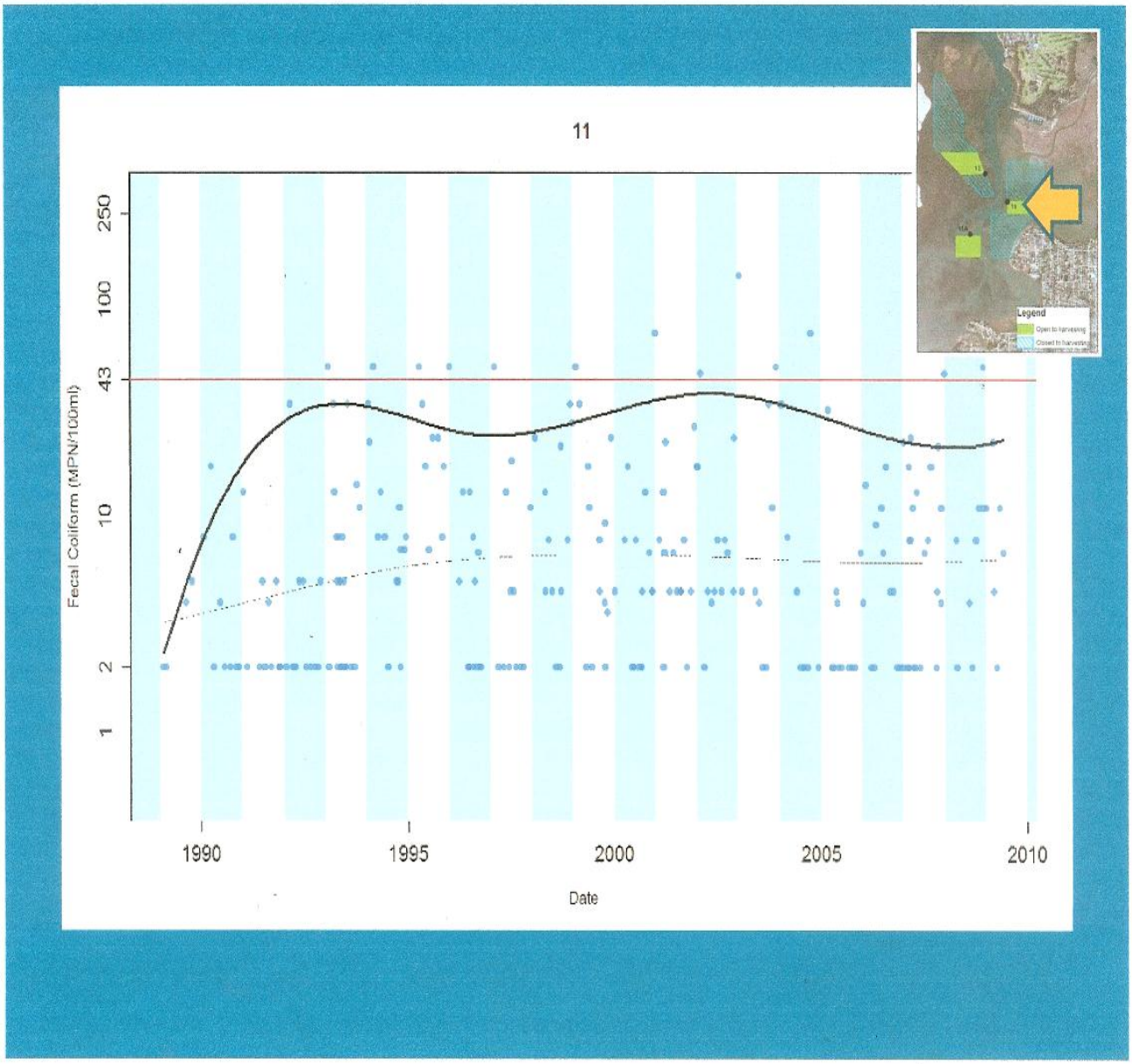


Site	% E. coli Exceedances
COL	4
TID	1
WIN	3
SPM	2
PAS	14
BAY	21
CIN	5
SHI	5

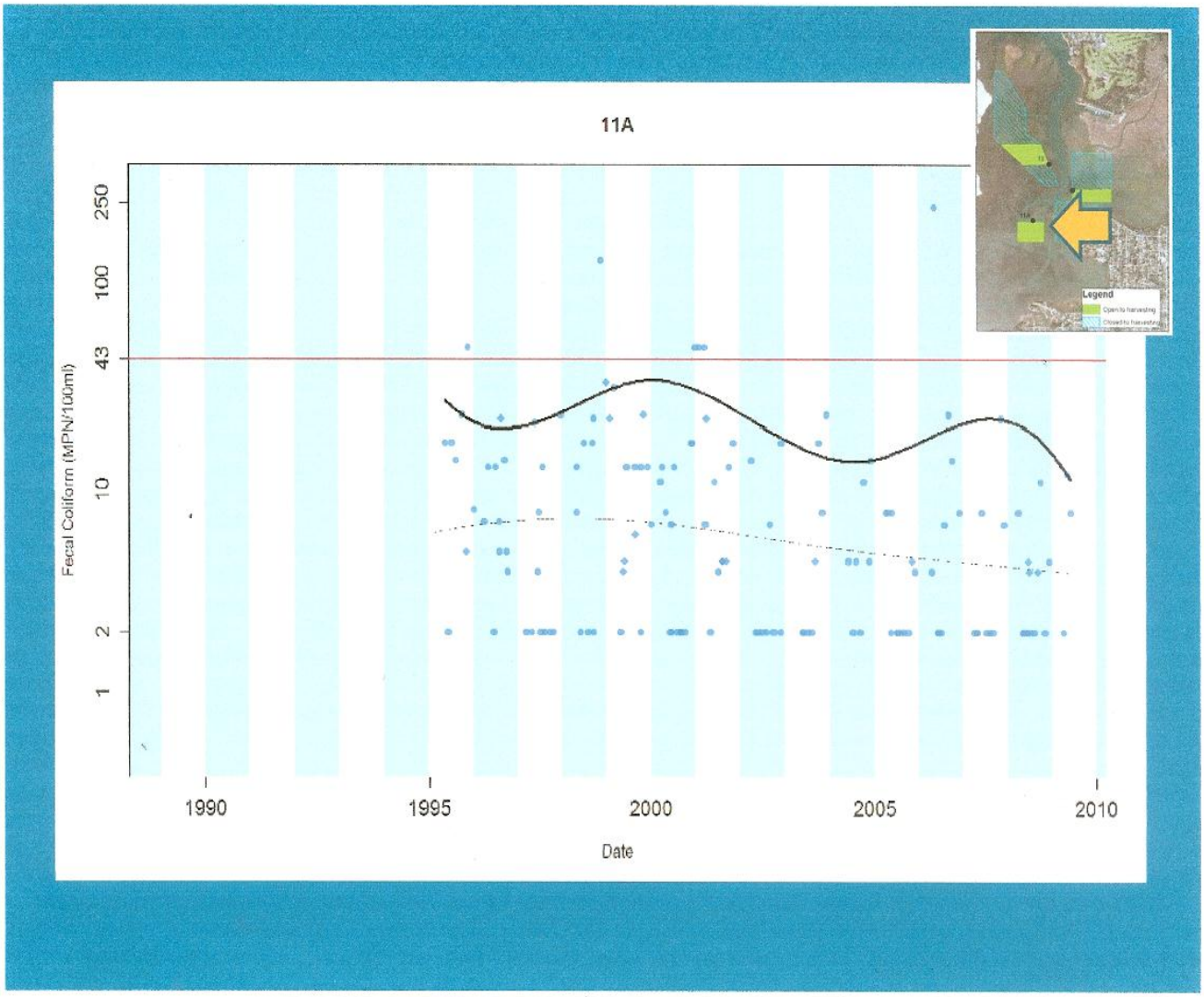
From the Morro Bay National Estuary Program (MBNEP)
Voluntary Monitoring Program (VMP) "Data Share: Bacteria"
September 15, 2009 http://www.mbnep.org/volunteer/summaries.php

Water Quality for Shellfish Growing Waters

- Two criteria must be met:
  - 90th percentile of 30 samples must be less than 43 MPN/100 mL
  - Geomean of 30 samples must be less than 14 MPN/100 mL
- Indicator: fecal coliform

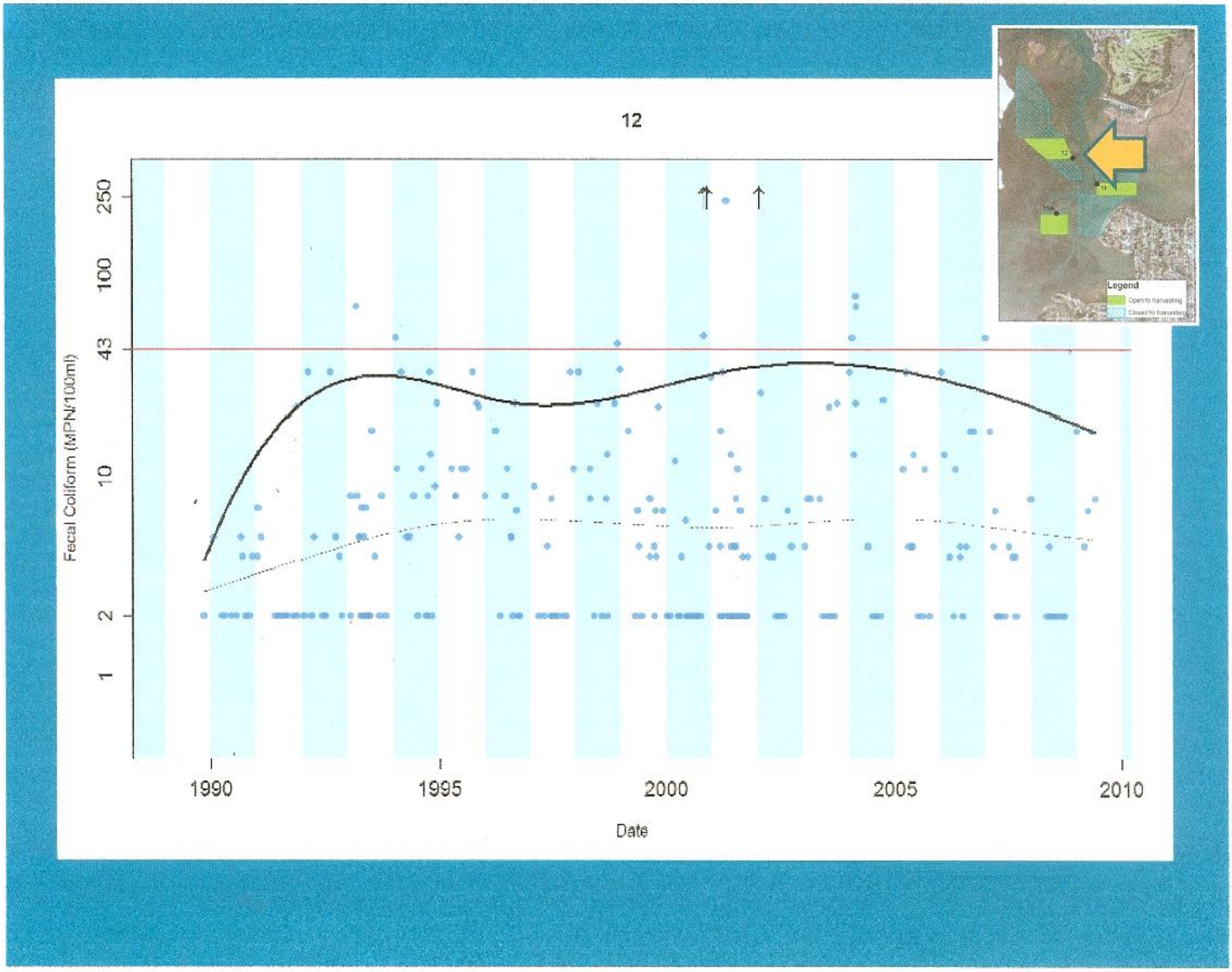


Fecal coliform tests have allowed shellfish harvesting near Los Osos at the three sites shown for at least 15 years. These charts show counts may be trending downward (see next two pages).



Counts appear to be dropping at the harvesting site most likely to be affected by Los Osos septic systems.

* Note that the latest readings show only one-fourth or so of the allowable limit.


12
Fecal Coliform (MPN/100ml)
250
100
43
10
2
1
1990
1995
2000
2005
2010
Date
Legend
Open to harvesting
Closed to harvesting

Water Quality Station Map

BM1 — T-Pier
35°22.251' N, 120°51.535' W

BS1 — Back Bay
35°20.029' N, 120°50.835' W

CM1 — Chorro and Los Osos Creeks
35°20.284' N, 120°49.950' W

CM2 — Chorro Creek (Retired 090521)
35°20.535' N, 120°49.691' W

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Center for Coastal Marine Sciences

Dashboard

Water Quality Monitoring — Live Data				
Parameter	BM1 T-Pier	BS1 Back Bay	CM1 Creeks	Units
Date	26-Mar-2010	26-Mar-2010	26-Mar-2010	
Time	18:46:33	19:01:52	17:52:39	UTC
Temperature	12.1505	14.5557	- - -	°C
Salinity	33.4164	24.0513	- - -	&permil
Conductivity	3.85121	3.0299	- - -	S/m
Depth	1.28524	1.56805	- - -	db
Tide	0.06924	*	*	m
Oxygen	255.626	236.3	- - -	µMol/l
Oxygen Saturation	76.28	74.295	- - -	%
Chlorophyll	6.18126	0.857508	- - -	µg/l
Turbidity	23.0533	5.40461	- - -	NTU
Nitrate	21.8325	19.572	- - -	µMol/l
Nitrate	1.3537	1.2136	- - -	mg/l

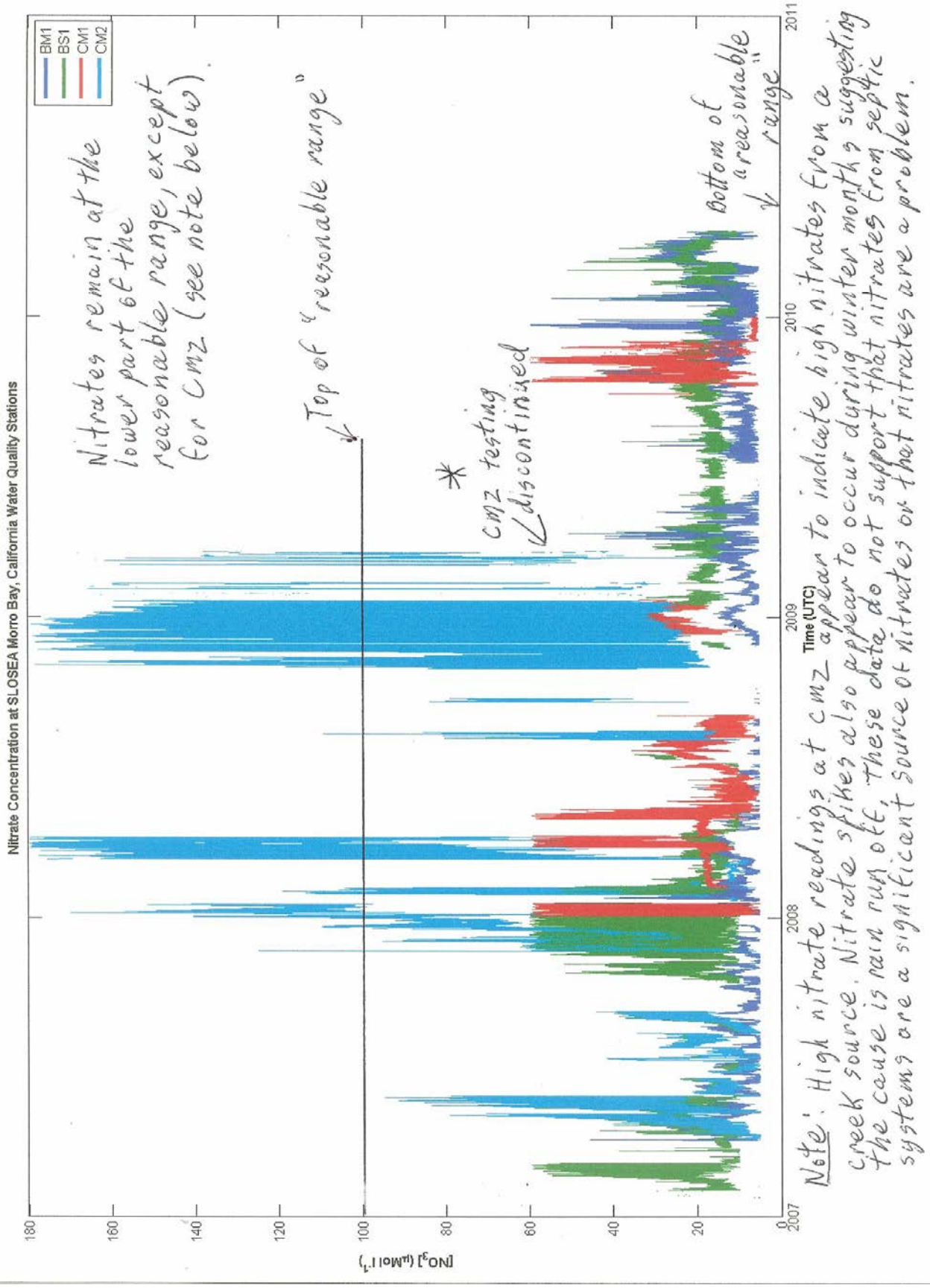
These data are preliminary. Values displayed in green have been characterized as "good data." Values displayed in red are not within a reasonable range for the parameter. This may mean that the instrument is malfunctioning or fouling has distorted the measurement.

* — Tide values are not yet characterized relative to pressure for BS1 & CM1.

- - - — No data are available.

°C — degrees Celsius; ‰ — parts-per-thousand; db — decibars, approximately relative meters; µMol/l — micromoles per liter; µg/l — micrograms per liter via fluorescence at 470 nm; S/m — Siemens per meter; NTU — Nephelometric Turbidity Unit, not affected by Colored (Chromophoric) Dissolved Organic Matter; mg/l — milligrams per liter.

BS1 Live Meteorological Data		
Parameter	SI Units	Imperial Units
Date	26-Mar-2010	
Time	18:42:22 UTC	
Air Temperature	14.09 °C	57.36 °F
Relative Humidity	50.98 %	
Dew Point	4.09 °C	39.37 °F
	22.66 km/h	14.08 mph



Note: High nitrate readings at CM2 appear to indicate high nitrates from a creek source. Nitrate spikes also appear to occur during winter months, suggesting the cause is rain run off. These data do not support that nitrates from septic systems are a significant source of nitrates or that nitrates are a problem.

From: bzelenke@calpoly.edu
To: fjaunion@aol.com
Sent: 4/23/2010 11:19:32 A.M. Pacific Daylight Time
Subj: RE: Request

Hi Mr. Ausilio,

Per our phone conversation this morning (4/23/2010), the following are the lower and upper bounds used for each water quality variable on the Dashboard website (http://www.slosea.org/news/dash.php) to flag measurements as falling outside the reasonable range for the parameter:

Temperature = <5 or >30

Salinity = <5 or >35

Conductivity = <0.7031 or >4.7914

Depth = <0 or >10

Tide = <-2 or >10

Oxygen = <0 or >500

Oxygen Saturation = <0 or >150

Chlorophyll = <0 or >15

Turbidity = <0 or >50

Nitrate (micro-Mol/l) = <0 or >100

Nitrate (mg/l) = <0 or >7

"Reasonable range" (100 micro-Mol/l is assumed to be below the safe limit.)

Cheers,
Brian

REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COASTAL REGION

STAFF REPORT

WATER QUALITY DATA
LOS OSOS/BAYWOOD PARK
SAN LUIS OBISPO COUNTY

August, 1987

William R. Leonard
Executive Officer

Roger Briggs
Supervising Engineer

Frank DeMarco & John Goni
Associate Engineers

Marty Wilder & Christy Echelmeier
Student Assistants

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LOS OSOS/BAYWOOD PARK
WATER QUALITY CONDITIONS

BACKGROUND

The Los Osos/Baywood Park area of San Luis Obispo County has been the subject of numerous groundwater quality studies since the adoption of a prohibition of additional individual wastewater disposal systems for the area in the Regional Board's Interim Water Quality Control Plan in 1971. That original prohibition was lifted by the Board in 1974, upon the promise by the county that an intensive, long term monitoring program would be conducted. Four years ago, the Regional Board used the data collected by the county (which did not continue the monitoring program at the frequency or level as promised), in addition to data collected by staff of the State Water Resources Control Board, and others, to establish that groundwater in the area was continuing to degrade, and that individual disposal systems were a significant part of the cause. Through an amendment to the Water Quality Control Plan for the Central Coastal Basin, the Regional Board ordered San Luis Obispo County to solve that part of the problem, and established a time schedule for project completion.

During the last four years, the County has tried to progress toward construction of a sewer system. It has not achieved that goal. The Regional Board has requested periodic project status reports from the County during this time. This staff report was prepared to summarize shallow ground water quality data collected from the Los Osos/Baywood area. It is intended to supplement a progress report the County will make to the Regional Board on September 4, 1987.

OBJECTIVE

To review concentrations of salts commonly used as indicators of sewage (nitrate, TDS, chloride, and sodium) within the Los Osos ground water basin and determine if any correlation between population growth and salt concentrations existed by comparing water quality data with population growth over time. Constituents other than nitrates were included in this report because if their concentrations rise along with nitrate concentrations, it provides a better indication that wastewater is a significant source. For example, few commercial fertilizers include sodium and chloride, but domestic waste water does contain elevated concentrations of those two constituents.

METHODOLOGY

Historic data are from an October 1973, Department of Water Resources report entitled "Los Osos-Baywood Ground Water Protection Study." The October, 1983 to February, 1987, water quality data are from the monitoring program San Luis Obispo County is conducting as required by Regional Board Resolution 83-13 (Note: data are unavailable between August, 1984, and May, 1987 because the County unilaterally discontinued the monitoring program). The County gave the May, 1987 data to Regional Board staff on August 17, 1987. These data were incorporated into the following evaluation. Well identification numbers used throughout this report are based on the state well numbering system. The first part of the number are the Township and Range, and the last four or five digits are the section number, subsection letter, and sequential number of the well. Thus, well number 30S/10E-10B5 would be the fifth well located in subsection "B" of Section "10" within Township 30 South, and Range 10 East. (Township and Range in the Los Osos Baywood area are all based on the Mount Diablo Base and Meridian.) Current wells being sampled are listed as follows:

30S/10E-13A7	30S/11E-7L3	30S/11E-18J6
-13L5	-7N1	-18Q1
-13Q1	-7Q1	-18R1
	-17F4	-21D3

Historic water quality data are not available for most of the current wells. To mitigate this problem, nearby wells were evaluated to see if they could be used to provide historic water quality data to be incorporated in this comparison. Nearby wells were evaluated and selected, based upon the following criteria:

-The nearby well's casing perforation intervals are approximately at the same elevation (relative to sea level) as the current well's, (Table 1);

-The nearby well is at approximately the same location with regard to development density (e.g. the adjoining well is not located at the fringes of a developed area if the current well is located in the middle of development), Figure 1;

-The nearby well is approximately at the same location within a ground water flow pattern (e.g. adjoining well is not too far up or down gradient of the current well). An accurate ground water contour map was not available, so the assumption was made ground water generally follows the topography, see Figure 2; and,

-The nearby well had a significant quantity of historical data available.

The above criteria eliminated a significant number of wells with historical water quality data. In each case, associated wells were selected to provide the most representative data available. The following table presents a listing of the wells currently being sampled by the County and the wells selected to provide historical ground water quality data for each of them.

Current Wells	Associated Wells
30S/10E-13A7	13A1, 13A6, 13A7, and 13B2
-13L5	13L1 and 13L2
-13Q1	13L1, 13L2, and 13P1
-23H1	(non-residential area)
30S/11E-7L3	7G3, 7N1, and 7Q1
-7N1	(complete history available)
-7Q1	(complete history available)
-17F4	(no associated well available)
-18J6	18H1
-18Q1	(complete history available)
-18R1	(historic data, but only one sample) and 18Q1
-21D3	21D4 and 21E1
	8R1 (agricultural drainage area)

Two wells, 30S/10E-23H1 (Figure 5) and 30S/11E-8R1 (Figure 6), were selected to give an indication of water quality in an undeveloped and agriculturally influenced area, respectively. Well 23H1 is located in the southwest corner of Los Osos outside the Board's prohibition boundary. Well 8R1 is located in the northeast corner of Baywood Park on the east side and adjacent to Los Osos Creek.

Water quality data used for enclosed graphs are in Table 2. Other items plotted on the enclosed graphs are described as follows:

TDS - Total Dissolved Solids: This value is based on taking seventy percent (70%) of the Electrical Conductivity (EC) value and dividing by ten (10). The reason for this approach is the February, 1987 water quality data provided by the County did not include TDS. In order to correlate this recent data to past data, it was decided to use the EC concentration and apply a "rule of thumb" factor for converting it to TDS (70% of EC will yield an approximate TDS value for the type of soils and ground water associated with the Los Osos/Baywood Park area). Values were divided by ten

for convenience of plotting on the same scale as the other constituents.

NO_3 - Nitrates: The values listed in the DWR October, 1973 report were given as nitrates. The County nitrate values were recorded as nitrogen. This report uses nitrate as nitrate. To convert nitrate as nitrogen to nitrate as nitrate, multiply the nitrate as nitrogen by 4.43 (atomic weight of Nitrate, 62, divided by the atomic weight of Nitrogen, 14, equals 4.43). Most of the nitrogen in sewage fresh out of the septic tank is in the form of ammonia and organic nitrogen. As effluent from septic tanks is discharged into the soil and eventually ground water via leach fields or pits, ammonia and organic nitrogen are converted by bacteria utilizing oxygen to nitrate. The ground water quality data submitted by the County include nitrogen sources in the form of ammonia, NH_3, and nitrite, N_2. However, concentrations associated with these constituents were very low. Generally, all nitrogen forms discharged to the soils of the Los Osos ground water basin will eventually be converted to nitrates. The Public Health Drinking Water Standard for nitrate is 45 mg/l as nitrate.

Cl - Chloride: This constituent was used as recorded in the literature.

Na - Sodium: This constituent was used as recorded in the literature sources.

Population: The population curve was obtained from the Brown and Caldwell "Phase I Water Quality Management Study," dated April, 1983, Figure 3-3, page 3-5, using the moderate growth curve. It should be noted the actual population from 1983 to present has been slightly less than the moderate growth curve. The population data shown on the graph have been divided by one-thousand (1000) in order to use the same scale used for other data. Growth factors employed are as follows:

Time Period	Population	Growth Factor (%/month)
1950-1960	600- 1,480	0.7552
1960-1965	1,480- 2,670	0.9882
1965-1970	2,670- 3,487	0.4459
1970-1975	3,487- 7,600	1.3070
1975-1980	7,600-10,933	0.6079
1980-1985	10,933-13,750	0.3828
1985-1990	13,750-15,300	0.1782

Rainfall: Rainfall data were obtained from the San Luis Obispo County Hydrology Unit. The purpose for including this information was to see if nitrate fluctuations were associated with the seasons (e.g. initial period of precipitation, early winter, would flush nitrates down to ground water, leading to higher concentrations. Continued precipitation, mid to late winter, will dilute the ground water leading to lower nitrate concentrations).

EVALUATION

The reader is directed to the Regional Board Staff Report for Resolution 83-13, dated September, 1983, for discussion on the sources of nitrates to ground water. In summary, it is the Regional Board's position, nitrate increases in the Los Osos ground water basin are primarily due to effluent from individual sewage disposal systems (septic tanks). In the following discussion, reference is made to residential development (also referred to as development or growth) as being the cause of the trends observed. This reference is meant to refer to increasing development causing additional septic tank effluent to be discharged to ground water.

The graphs were evaluated by grouping them based on geographic and demographic areas (subareas) within the Los Osos/Baywood Park study area (Figure 1A). The sections are generally described as follows:

EAST - The area east of Los Osos Creek is the agriculturally influenced area, represented by wells 30S/11E-21E1, 21D3, 21D4, and 8R1 (Figures 3, 4 & 5).

UNDEVELOPED - The southwestern portion of the study area outside both the Regional Board prohibition boundary and the developed areas of Los Osos/Baywood Park, represented by well 30S/10E-23H1 (Figure 6).

SOUTHEAST - The densely developed areas, located in the southeast quarter of the prohibition area, represented by wells 30S/11E-18J6, 18H1, 18R1, and 18Q1 (Figure 7, 8, & 9).

LARGE PARCELS - The large parcel (one acre or larger) areas located west and adjacent to Los Osos Creek outside the prohibition area, represented by well 30S/11E-17F4 (Figure 11).

SOUTHWEST - The densely developed areas located in the southwest quarter of the prohibition area, represented

by wells 30S/10E-13L1, 13L2, 13L5, 13P1, and 13Q1 (Figure 12, 13, 14, 15 & 16).

CENTRAL - The densely developed areas located in the western central portion of the prohibition area, represented by wells 30S/10E-13A1, 13A2, 13A6, 13A7, and 13B2 (Figure 17, 18, 19 & 20).

NORTH - The densely developed sections located in the northern portion of the prohibition area, represented by wells 30S/10E-7G3, 7L3, 7N1, and 7Q1 (Figure 21, 22, 23 & 24).

The following discussions of the water quality data and the graphs mentioned above are grouped by these areas. At the conclusion of the discussion of each area, a table of average historical and current salt concentration values are presented for each area to provide a quick, and somewhat simplistic summary of what the data show. These values are useful for quick comparisons, but should not be taken as absolutely perfect representations of groundwater quality (Figure 1A).

EAST (wells 30S/11E-21D3, 21D4, 21E1, and 8R1)

Well 8R1 (Figure 5) was selected as an indicator of the historic water quality data in a remote undeveloped portion of the agricultural area east of Los Osos Creek. It indicates TDS, Na and Cl concentrations in the sixties are consistent with more recent data from wells 21D4, 21D3, and 21E1 (Figures 3 and 4). These three wells are also in a similar land use area in the "east" subarea (residential/agricultural). However, nitrate concentrations have increased (taking the extremes) from 2 mg/l to over 100 mg/l. Wells 21D4, and 21D3 (Figure 4), generally indicate a continued high concentration, 60 mg/l or greater of nitrates over the last 17 years, probably due to historic and current agricultural practices in this immediate area. The area near wells 21D3, 21D4 and 21E1 have seen an increase in both residential development and agricultural usage over the past 26 years. There appears to be correlation between development and nitrate increases.

Concentration	Average Concentrations, mg/l Past	Present
TDS	800	800
NO_3	5	80
Cl	100	100
Na	60	60

UNDEVELOPED (well 30S/10E-23H1)

Well 23H1 (Figure 6) was selected as an indicator of pre-development water quality and is used as a comparison for the other wells west of Los Osos Creek which also has undeveloped areas. Salt concentrations from this well are low for all indicators. This well provides a glimpse of how good the natural quality of the shallow ground water in the Los Osos/Baywood Park really is.

Concentration	Average Concentrations, mg/l Past
TDS	200
NO_3	8
Cl	45
Na	30

SOUTHEAST (wells 30S/11E-18H1, 18J6, 18Q1, and 18R1)

Well 18R1 (Figure 7 & 8) had only one historic data reference, but indicates a significant increase in all constituents (nitrates went from 3 to 66 mg/l). However, to supplement historic water quality data, well 18Q1 (Figure 8) was used. Well 18Q1's historic water quality data, combined with well 18R1's present water quality data, indicate the upward trend of nitrate, sodium, and total dissolved solids (nitrates went from 28 to 55/mg/l). It appears the development in this area, which has been significant over the past ten years, correlates well with these increases.

However, well 18Q1's (Figure 10), historic and present water quality data, by itself, show a decreasing trend for nitrates, a constant trend for TDS, and an increasing trend for sodium and chloride. Well 18J6 (combined with 18H1 in Figure 9) shows a slight increase in nitrate values in a developed area. When associated with well 18H1 (Figure 9), there appears to be no increase in nitrate, but all the other constituents have increased. Averaging all data from the southeast area, all constituents show an increase.

Concentration	Southeast Average Concentrations, mg/l Past	Present
TDS	180	260
NO_3	20	26
Cl	40	55
Na	25	40

LARGE PARCELS (well 30S/11E-17F4)

Well 17F4 (Figure 11) represents water quality in the lowest density areas west of Los Osos Creek (lot sizes one acre or larger). Historic data weren't available for this well and there were no comparable adjoining wells. The 1983-87 nitrate concentrations are less than 20 mg/l, indicating, in the less densely populated areas, nitrate remains fairly low.

Concentration	Average Concentrations, mg/l Present
TDS	400
NO_3	10
Cl	85
Na	60

SOUTHWEST (wells 30S/10E-13L1, 13L2, 13L5, 13P1, and 13Q1)

Three wells, 13L1 (Figure 12), 13L2 (Figure 13) and 13P1 (Figure 14), were associated with well 13Q1. This association gave three alternative historic trends which indicated significant increases in all constituents. Two wells, 13L1 (Figure 15) and 13L2 (Figure 16), were associated with 13L5. Two graphs were produced indicating significant increase in all constituents over time.

Concentration	Average Concentrations, mg/l Past	Present
TDS	150	400
NO_3	5	85
Cl	30	65
Na	25	80

CENTRAL (wells 30S/10E-13A1, 13A2, 13A6,13B2, and 13A7)

Four wells, 13A1 (Figure 17), 13A2 (Figure 18), 13A6 (Figure 19), and 13B2 (Figure 20), were associated with well 13A7. This association produced four graphs which indicate the concentrations have remained relatively constant over the past twenty-five years, but at a high concentration. This is as expected, given this is downgradient of a densely developed area, and is within an older developed area. When comparing well 13A7 to 23H1 (Figure 6), which is indicative of a pre-developed area, degradation of water quality has been significant and is continuing.

Concentration	Average Concentrations, mg/l Past	Present
TDS	300	300
NO_3	40	40
Cl	60	70
Na	40	50

NORTH (wells 30S/10E-7G3, 7L3, 7N1, and 7Q1)

Three wells 7G3 (Figure 21), 7N1 (Figure 22), and 7Q1 (Figure 23) were associated with well 7L3. The three graphs developed show a significant increase in all constituents over time.

Well 7Q1 (Figure 24), in and of itself, has adequate historic water quality data, and there can be no doubt degradation has occurred over time in this high growth area.

Well 7N1 (Figure 25), shows an increase in all constituents. However, the concentrations are fairly low.

Concentration	Average Concentrations, mg/l Past	Present
TDS	150	350
NO_3	10	60
Cl	30	60
Na	20	50

CONCLUSION

The salts used in this analysis are merely indicators of the presence of waste water. With the exception of nitrates, they are not harmful in themselves unless present in such high concentrations that most people would not consume the water because of its taste. Treatment for their removal does not necessarily make the resulting water free of other materials contained in sewage which could be harmful if consumed. Higher nitrate concentrations in ground water can be caused by the use of commercial fertilizers for landscaping, and urban areas tend to use significant quantities of fertilizer. But when other salt constituent concentrations increase, too, the possibility of waste water being a significant factor becomes important.

Analysis of the data examined for this report clearly shows that the quality of the shallow ground water in much of the

Los Osos/Baywood Park area is being changed by the urbanization of the area. The preponderance of evidence shows increasing mineralization of ground water over time. In the more densely developed area of Los Osos/Baywood Park, only one well suggests a downward trend for nitrate concentrations. Of even more concern is the fact that some of the wells are showing relatively steep increases in mineralization in recent years. Since water quality in the undeveloped area 25 years ago had lower mineral concentrations than any of the groundwater existing under the developed areas now, staff attributes the changes which have occurred to the increasing residential development densities. The staff report prepared for the original hearing four years ago showed that, of the sources identified (urban irrigation, commercial and residential sewage, agricultural irrigation), residential waste water contributed more than 80% of the nitrogen in the Los Osos/Baywood shallow groundwater basin. No evidence to change that conclusion exists today.

The facts are inescapable. The shallow ground waters in the Los Osos/Baywood area are continuing to be degraded. The discharges from individual and community waste water systems are the major source, and they can be controlled.

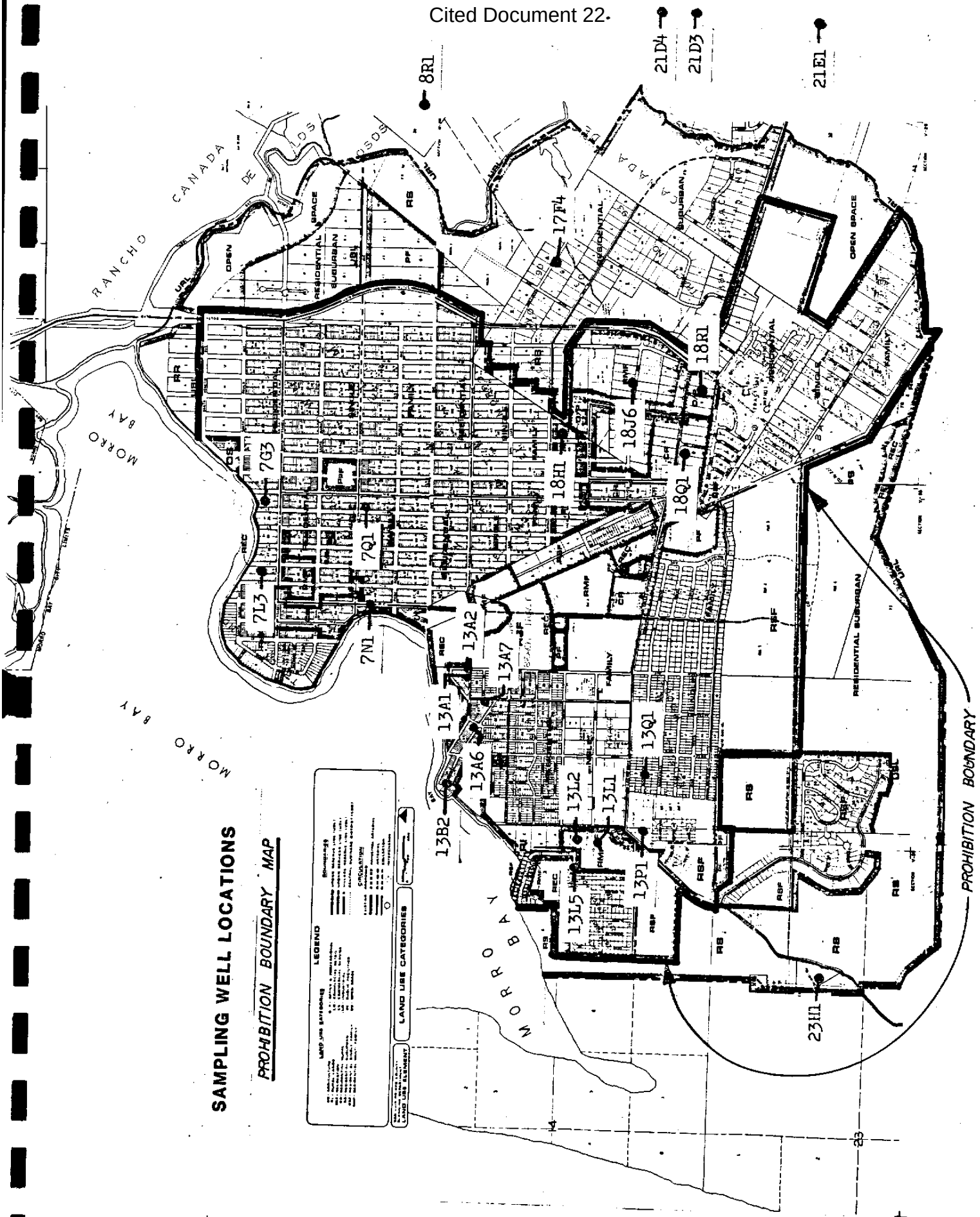

SAMPLING WELL LOCATIONS
PROHIBITION BOUNDARY MAP
LEGEND
LAND USE CATEGORIES
RANCHO CANADA DE LOS OSOS
MORRO BAY
MORRO BAY
PROHIBITION BOUNDARY
8R1
21D4
21D3
21E1
17F4
18R1
18J6
18H1
18Q1
7G3
7Q1
7L3
7N1
13A2
13A7
13A1
13A6
13B2
13Q1
13L2
13L1
13P1
13L5
23H1
OPEN SPACE
RESIDENTIAL SUBURBAN
RESIDENTIAL FAMILY
RS
RSF
REC
OSC

FIGURE 1

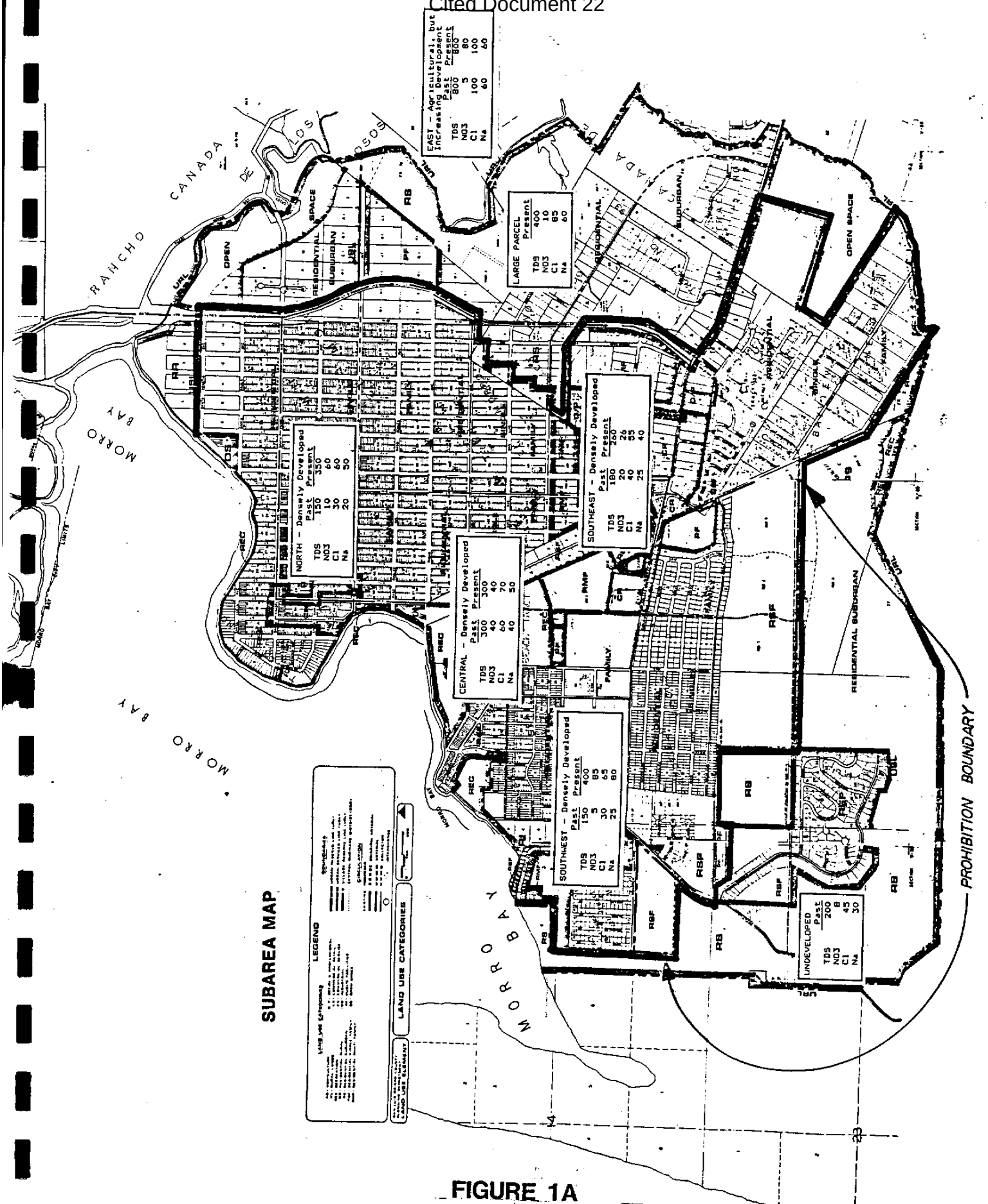
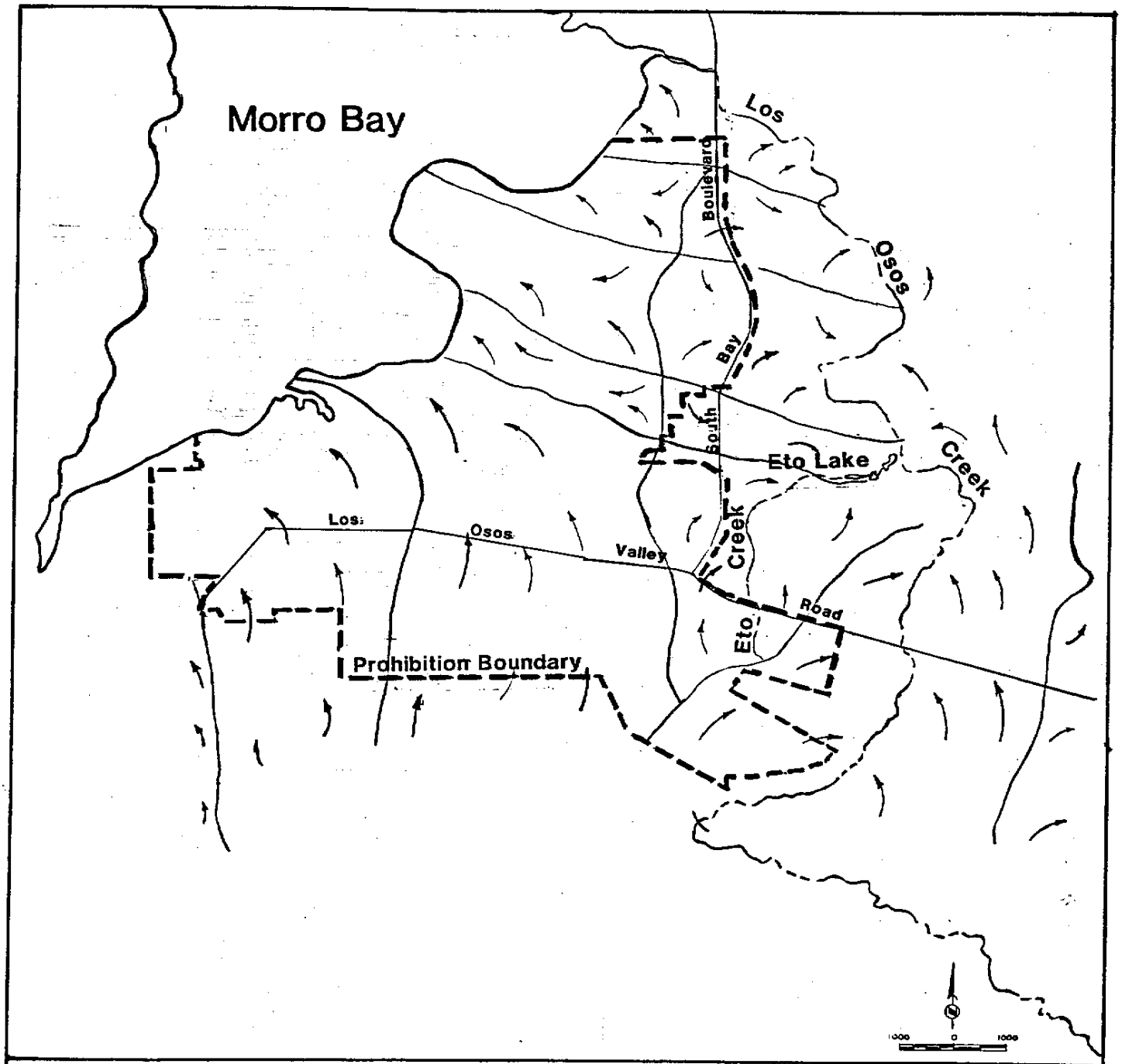

EAST - Agricultural, but Increasing Development
Past Present
TDS 800 800
NO3 5 80
Cl 100 100
Na 60 60
LARGE PARCEL
Past Present
TDS 400 400
NO3 10 10
Cl 65 65
Na 60 60
NORTH - Densely Developed
Past Present
TDS 150 350
NO3 10 60
Cl 30 60
Na 20 50
CENTRAL - Densely Developed
Past Present
TDS 300 300
NO3 40 40
Cl 60 70
Na 40 50
SOUTHEAST - Densely Developed
Past Present
TDS 180 260
NO3 20 26
Cl 40 55
Na 25 40
SOUTHWEST - Densely Developed
Past Present
TDS 150 400
NO3 5 85
Cl 30 45
Na 25 80
UNDEVELOPED
Past
TDS 200
NO3 8
Cl 45
Na 30
RANCHO CANADA DE LOS OSOS
MORRO BAY
MORRO BAY
MORRO BAY
OPEN SPACE
RESIDENTIAL SUBURBAN
RESIDENTIAL SUBURBAN
OPEN SPACE
RESIDENTIAL SUBURBAN
FAMILY
LEGEND
LAND USE CATEGORIES
SUBAREA MAP
PROHIBITION BOUNDARY

FIGURE 1A



TOPOGRAPHY

(Topographic Highs/Surface Water Flow Patterns)

FIGURE 2

WATER QUALITY GRAPHS

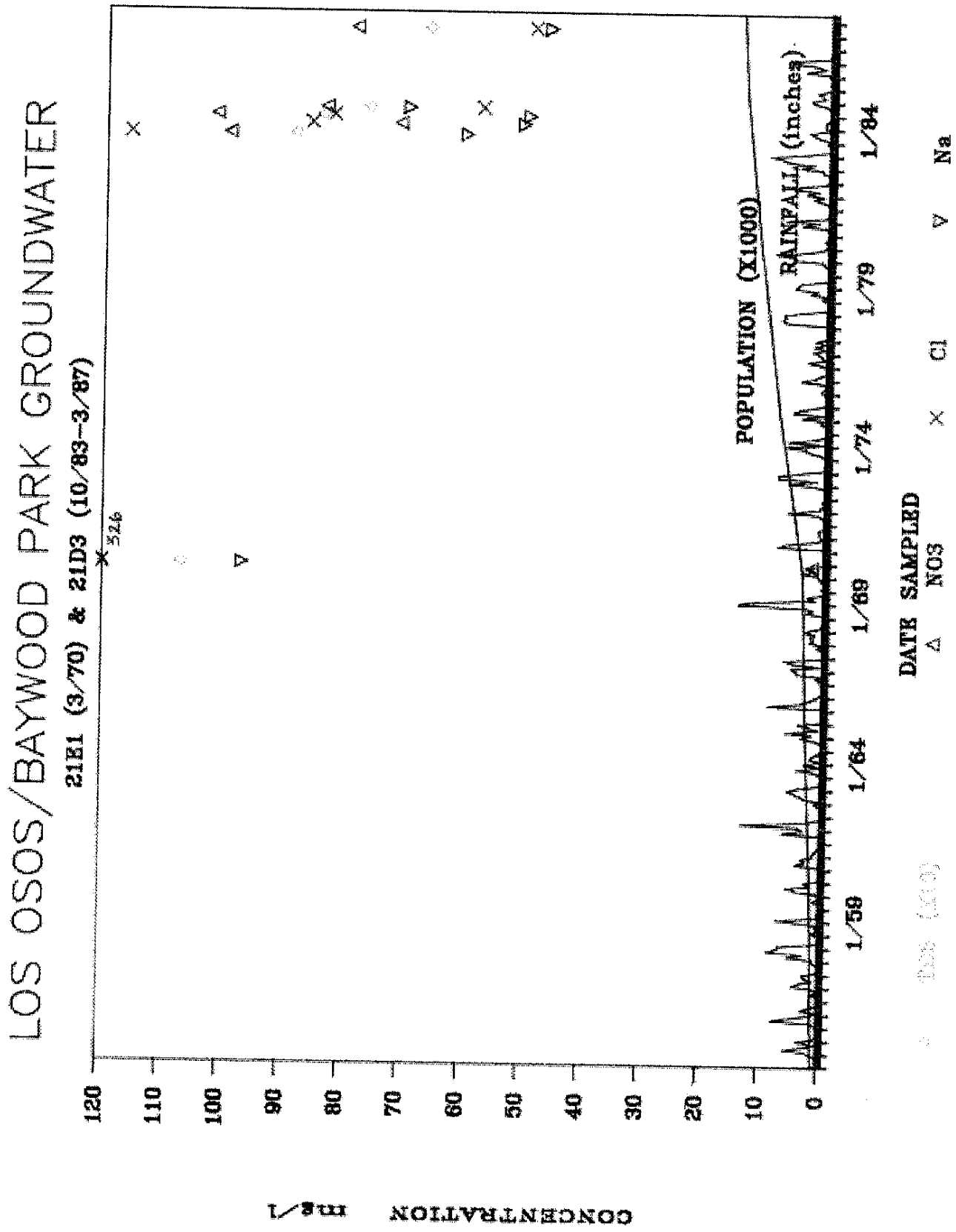

LOS OSOS/BAYWOOD PARK GROUNDWATER
21E1 (3/70) & 21D3 (10/83-3/87)
526
POPULATION (X1000)
RAINFALL (inches)
DATE SAMPLED
NO3
Cl
Na
1/59
1/64
1/69
1/74
1/79
1/84
0
10
20
30
40
50
60
70
80
90
100
110
120
CONCENTRATION mg/l

FIGURE 3

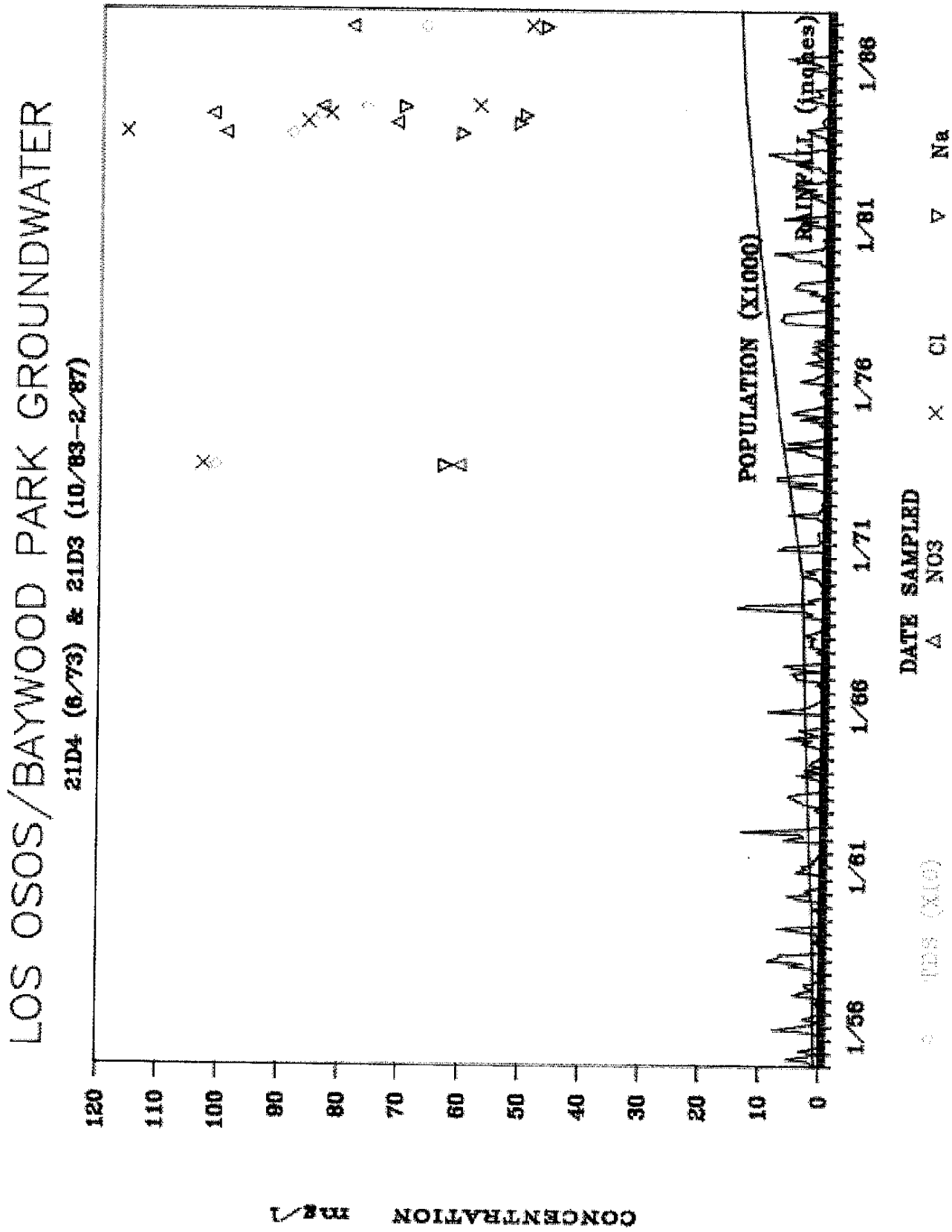

LOS OSOS/BAYWOOD PARK GROUNDWATER
21D4 (6/73) & 21D3 (10/83-2/87)
POPULATION (X1000)
RAINFALL (inches)
DATE SAMPLED
NO3
Cl
Na
TDS (X10)
CONCENTRATION mg/l
120
110
100
90
80
70
60
50
40
30
20
10
0
1/56
1/61
1/66
1/71
1/76
1/81
1/86

FIGURE 4

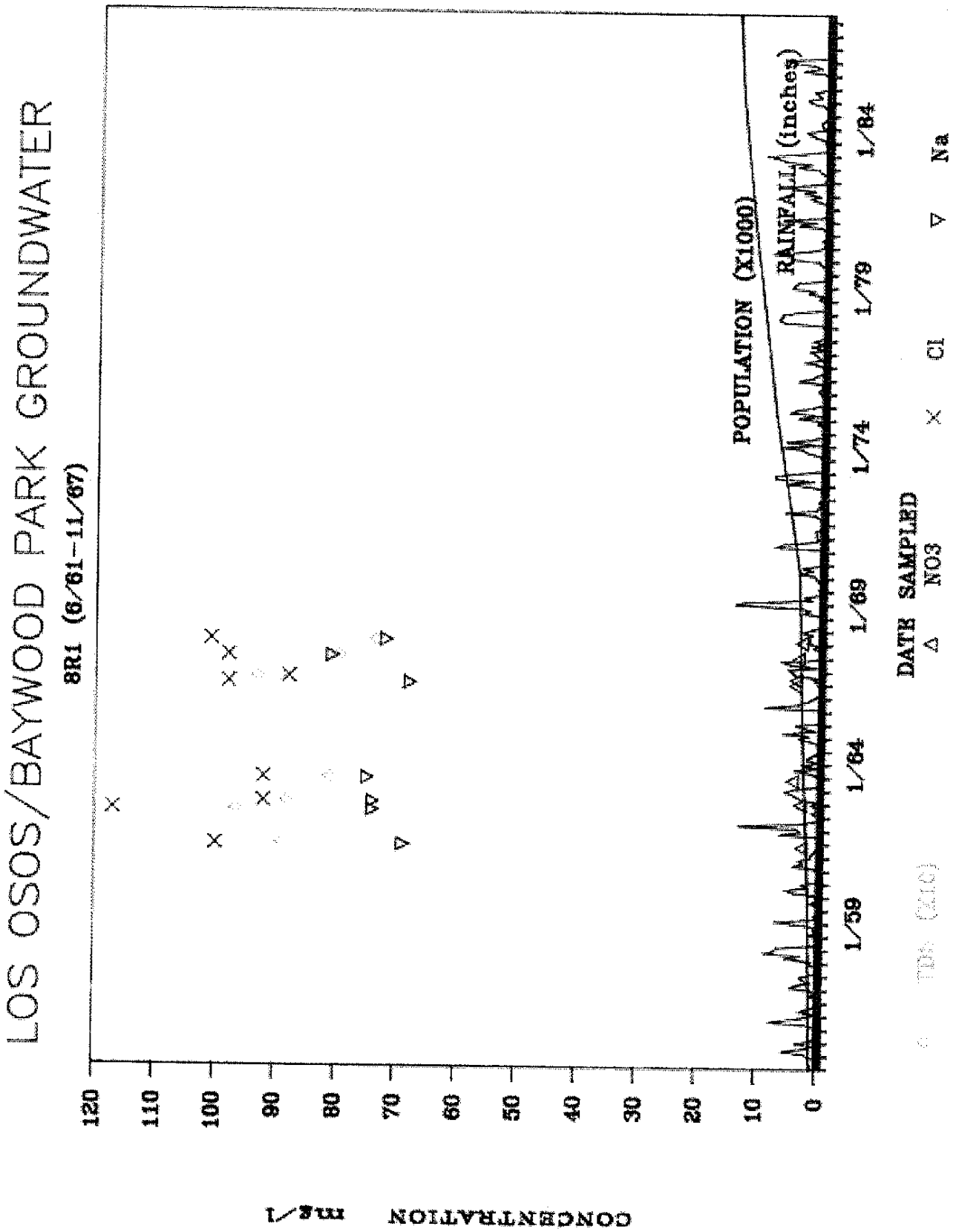

LOS OSOS/BAYWOOD PARK GROUNDWATER
8R1 (6/61-11/67)
CONCENTRATION mg/l
120
110
100
90
80
70
60
50
40
30
20
10
0
1/59
1/64
1/69
1/74
1/79
1/84
DATE SAMPLED
POPULATION (X1000)
RAINFALL (inches)
NO3
Cl
Na

FIGURE 5

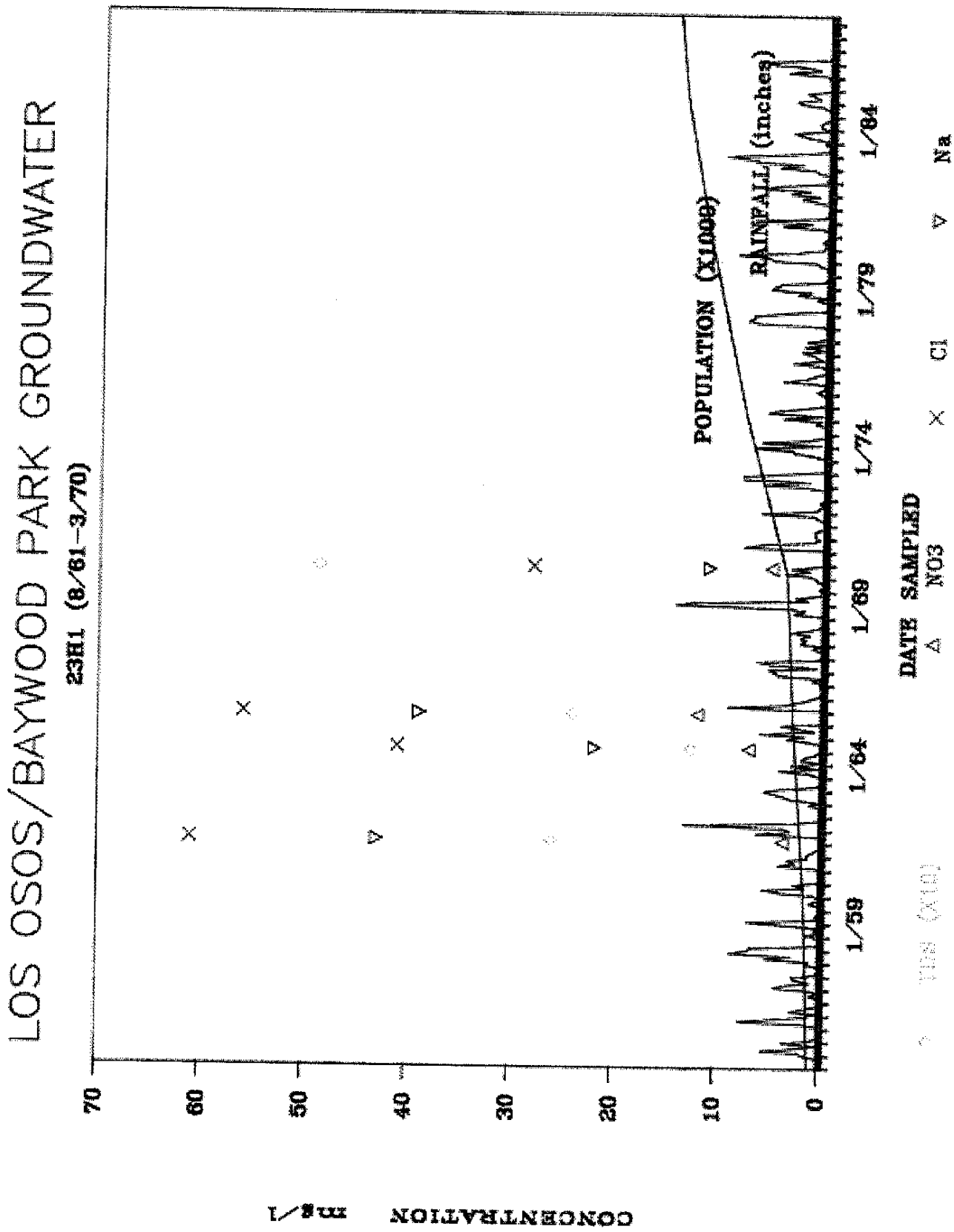

LOS OSOS/BAYWOOD PARK GROUNDWATER
23H1 (8/61-3/70)
CONCENTRATION mg/l
70
60
50
40
30
20
10
0
1/59
1/64
1/69
1/74
1/79
1/84
DATE SAMPLED
NO3
Cl
Na
POPULATION (X1000)
RAINFALL (inches)

FIGURE 6

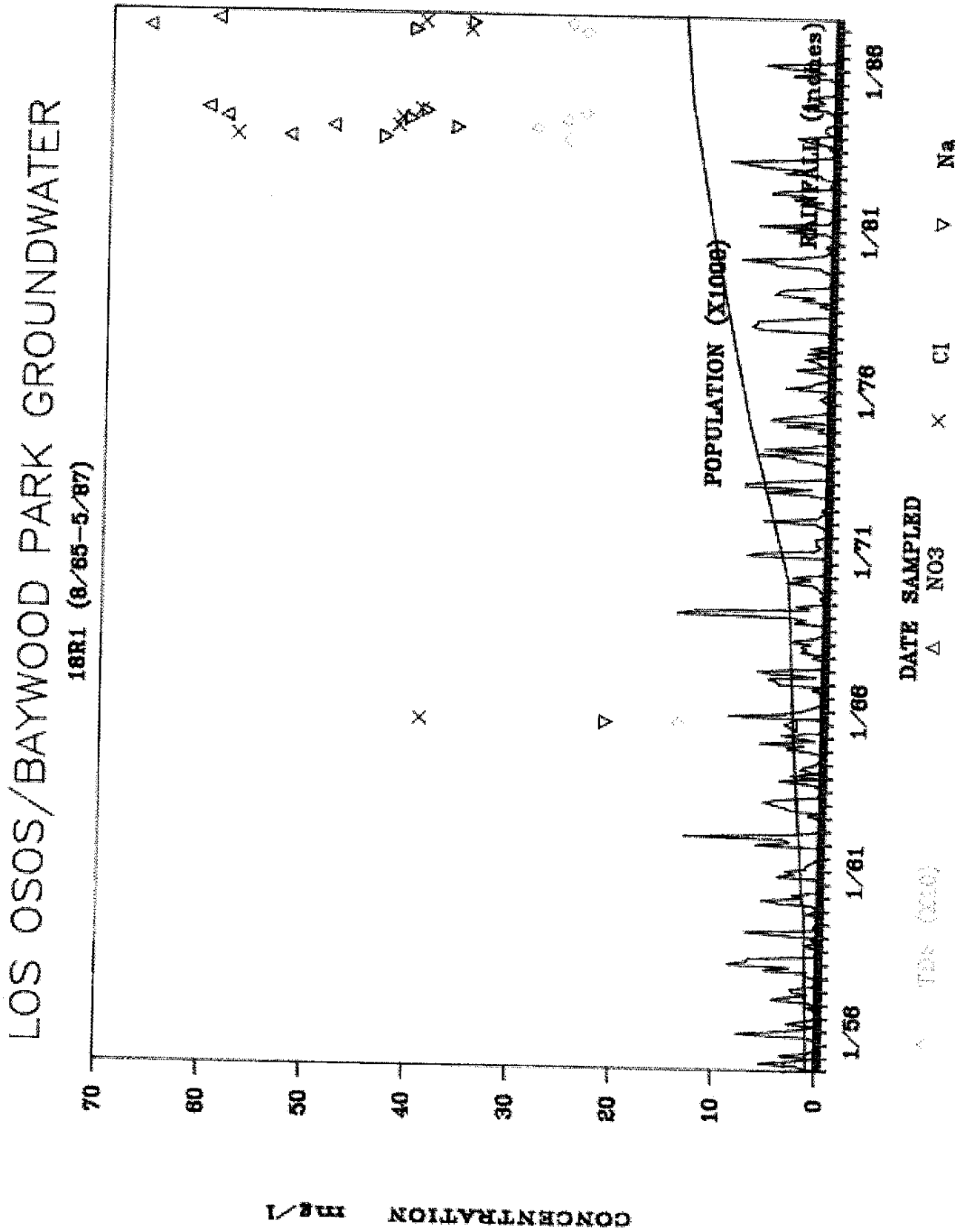

LOS OSOS/BAYWOOD PARK GROUNDWATER
18R1 (8/65-5/87)
CONCENTRATION mg/l
70
60
50
40
30
20
10
0
1/56
1/61
1/66
1/71
1/76
1/81
1/86
DATE SAMPLED
POPULATION (X1000)
RAINFALL (Inches)
NO3
Cl
Na

FIGURE 7

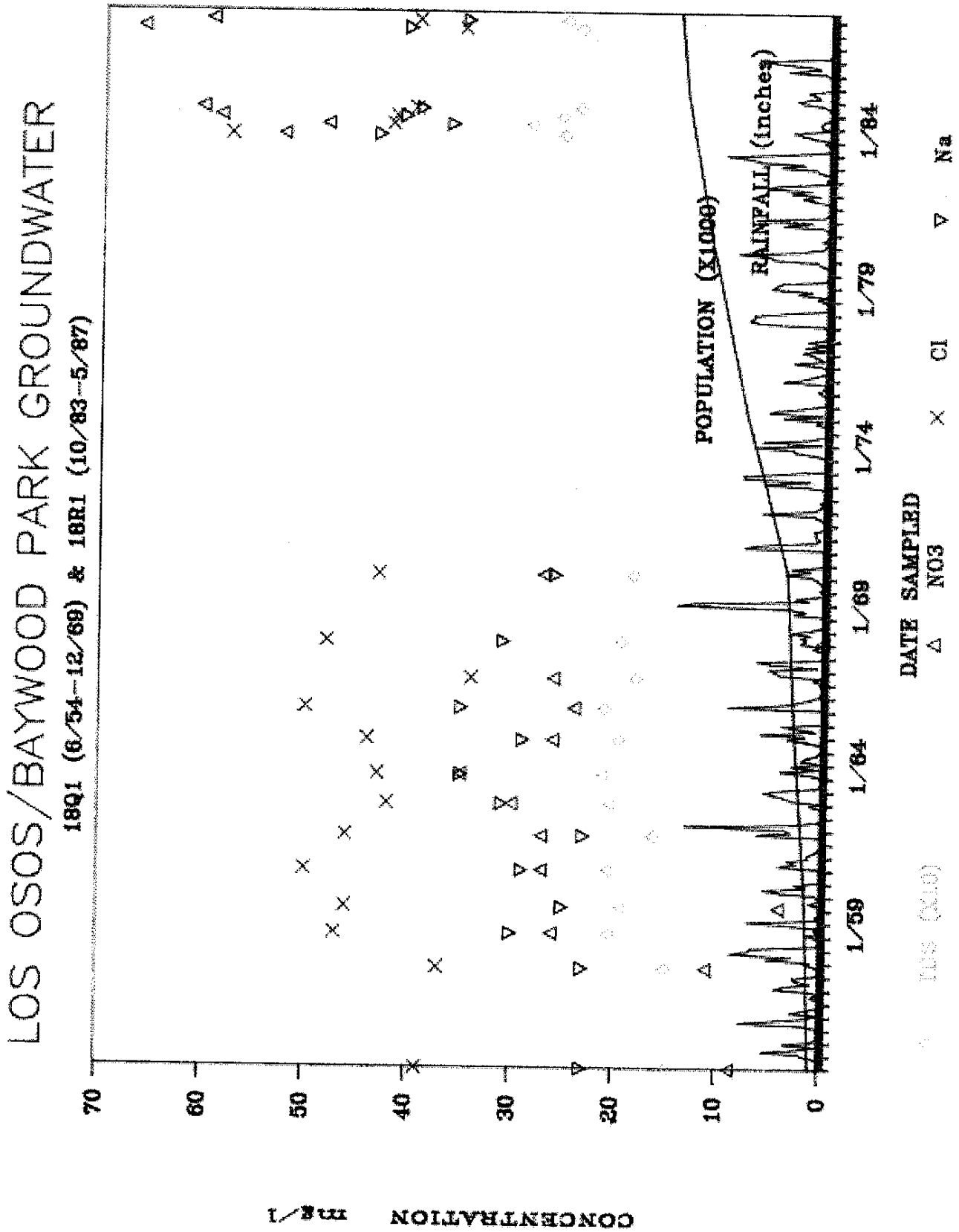

LOS OSOS/BAYWOOD PARK GROUNDWATER
18Q1 (6/54-12/69) & 18R1 (10/83-5/87)
CONCENTRATION mg/l
70
60
50
40
30
20
10
0
POPULATION (X1000)
RAINFALL (inches)
1/59
1/64
1/69
1/74
1/79
1/84
DATE SAMPLED
NO3
Cl
Na

FIGURE 8

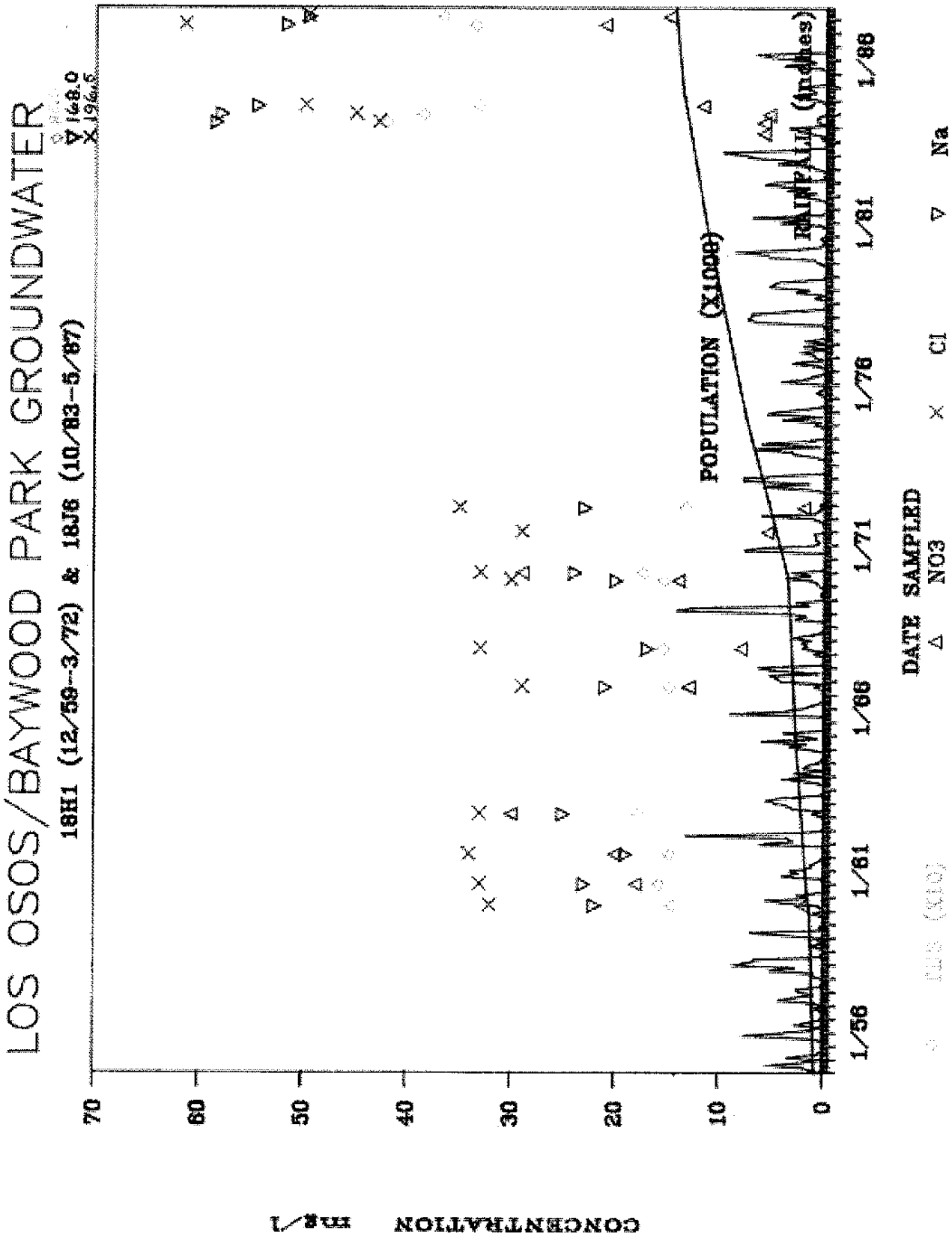

LOS OSOS/BAYWOOD PARK GROUNDWATER
18H1 (12/59-3/72) & 18J6 (10/83-5/87)
168.0
1964.5
POPULATION (X1000)
RAINFALL (inches)
DATE SAMPLED
NO3
Cl
Na
CONCENTRATION mg/l
70
60
50
40
30
20
10
0
1/56
1/61
1/66
1/71
1/76
1/81
1/86

FIGURE 9

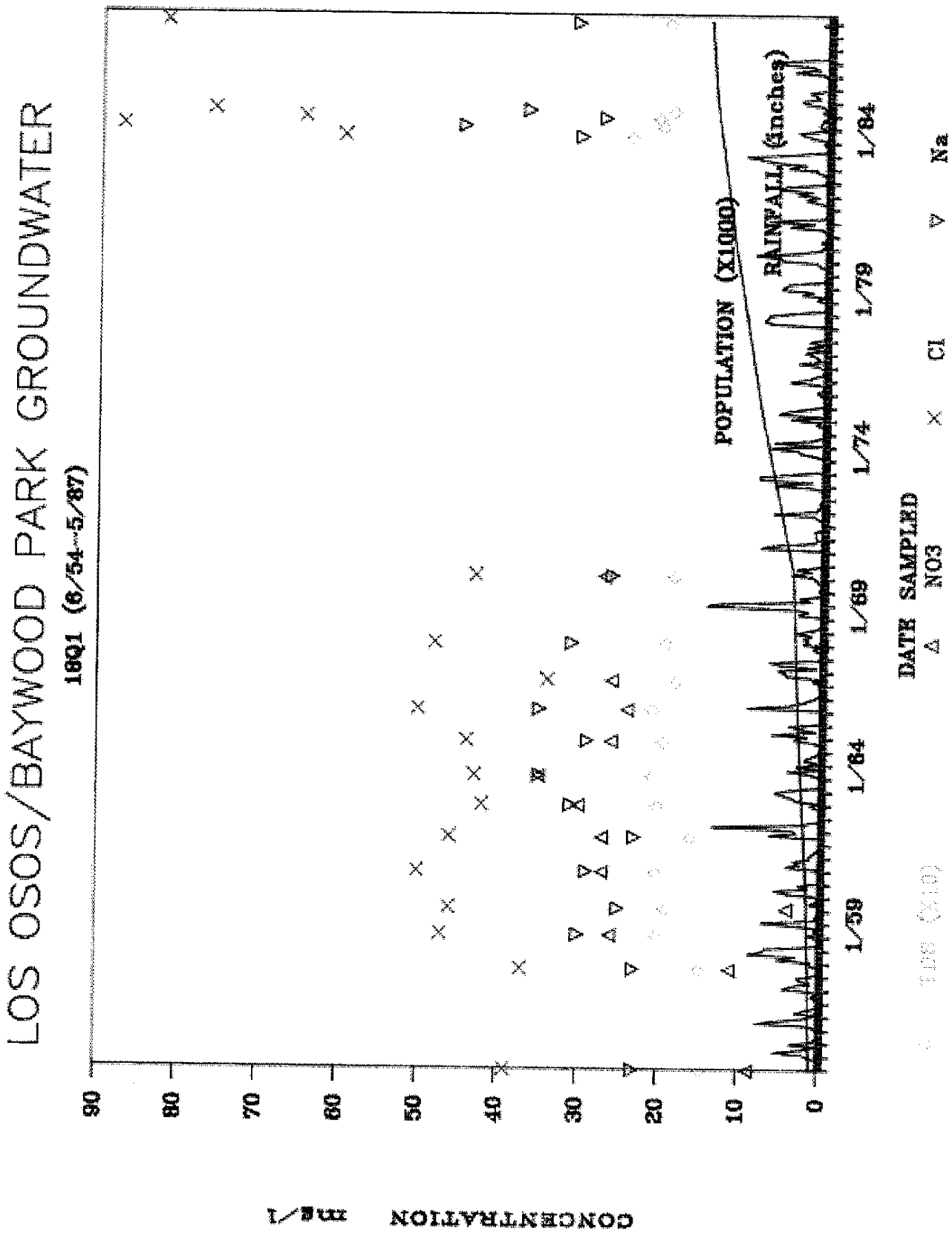

LOS OSOS/BAYWOOD PARK GROUNDWATER
18Q1 (6/54--5/87)
CONCENTRATION mg/l
90
80
70
60
50
40
30
20
10
0
1/59
1/64
1/69
1/74
1/79
1/84
DATE SAMPLED
POPULATION (X1000)
RAINFALL (inches)
NO3
Cl
Na

FIGURE 10

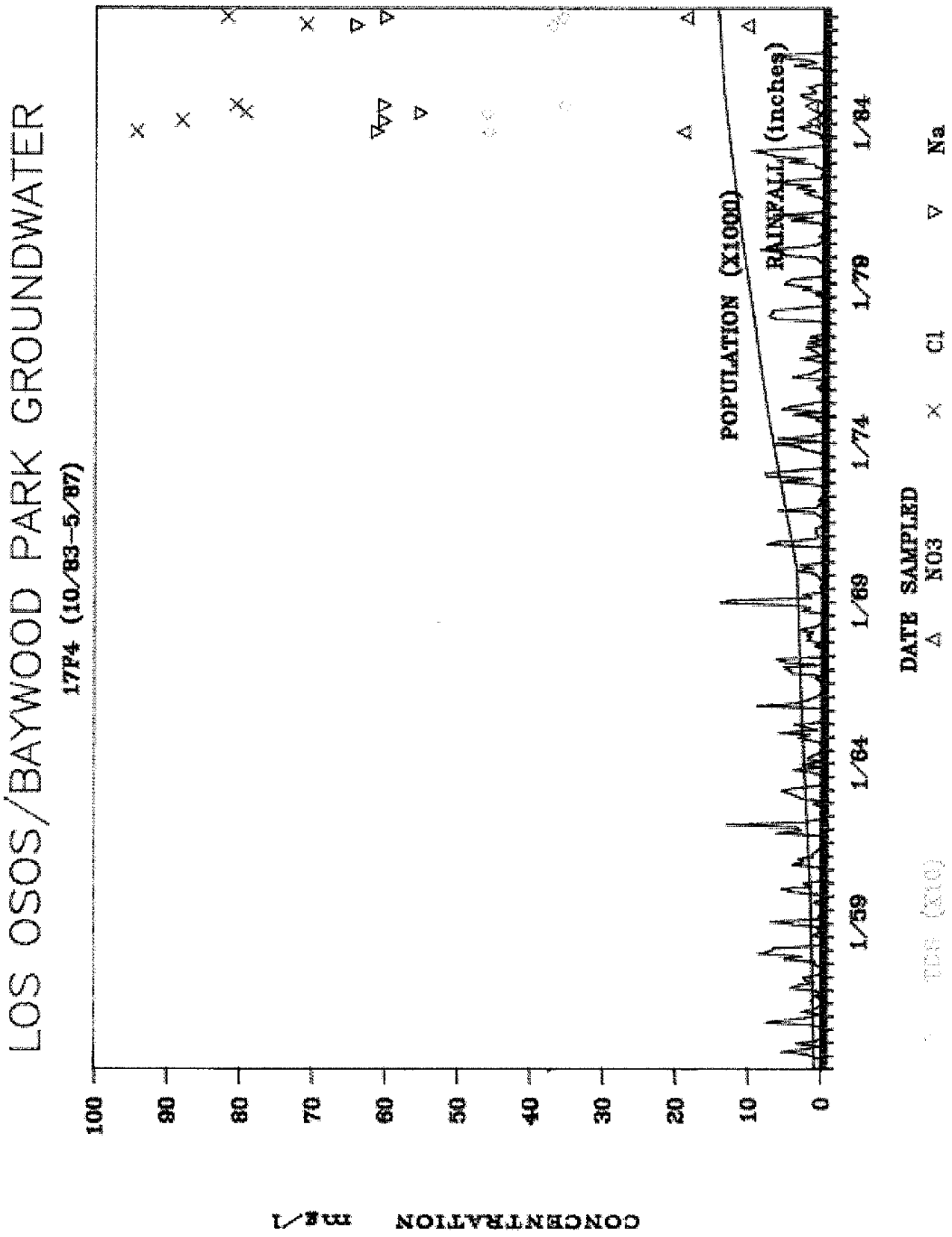

LOS OSOS/BAYWOOD PARK GROUNDWATER
17P4 (10/83-5/87)
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
1/59
1/64
1/69
1/74
1/79
1/84
DATE SAMPLED
POPULATION (X1000)
RAINFALL (inches)
NO3
Cl
Na

FIGURE 11

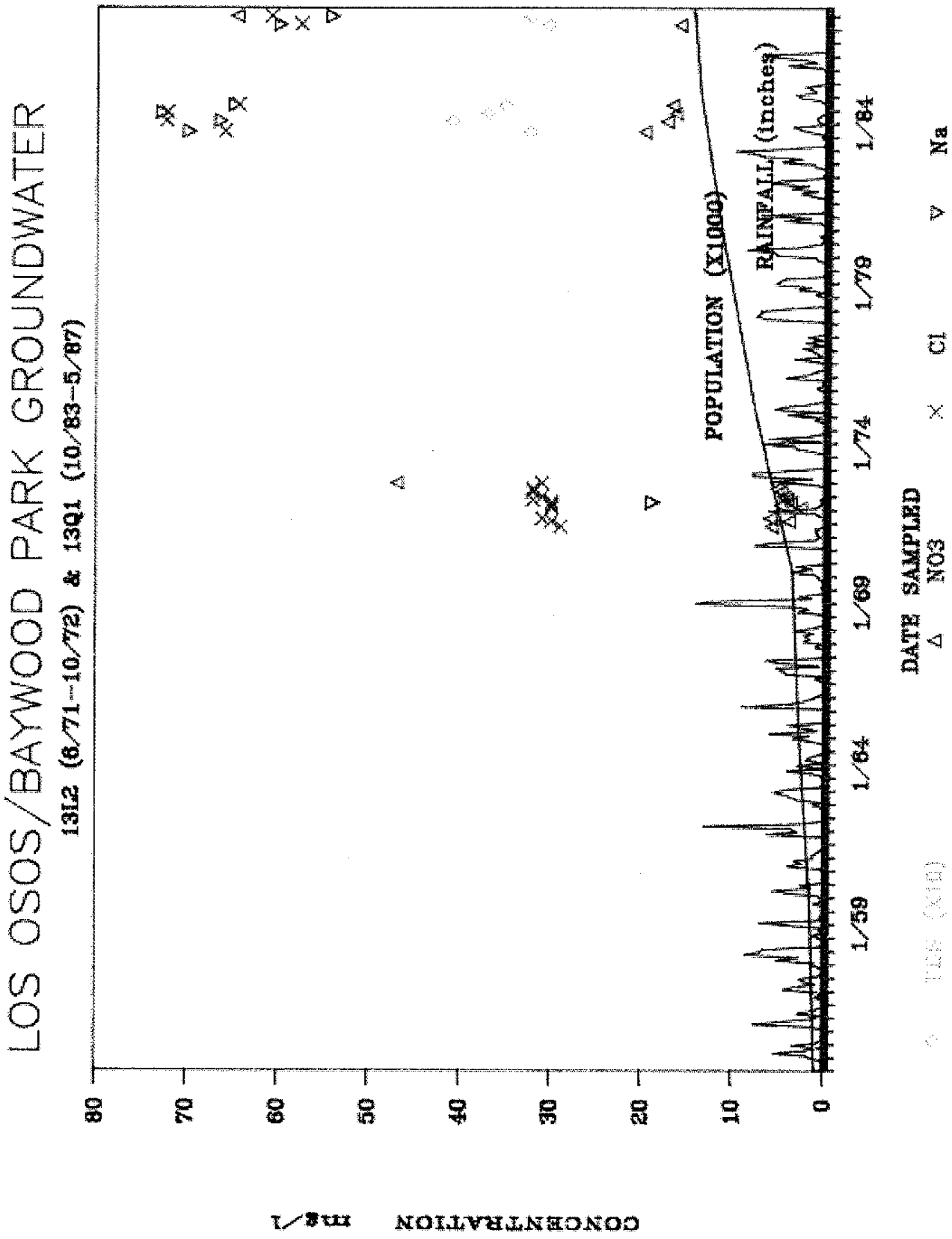

LOS OSOS/BAYWOOD PARK GROUNDWATER
13L2 (6/71-10/72) & 13Q1 (10/83-5/87)
CONCENTRATION mg/l
80
70
60
50
40
30
20
10
0
1/59
1/64
1/69
1/74
1/79
1/84
DATE SAMPLED
POPULATION (X1000)
RAINFALL (inches)
NO3
Cl
Na

FIGURE 13

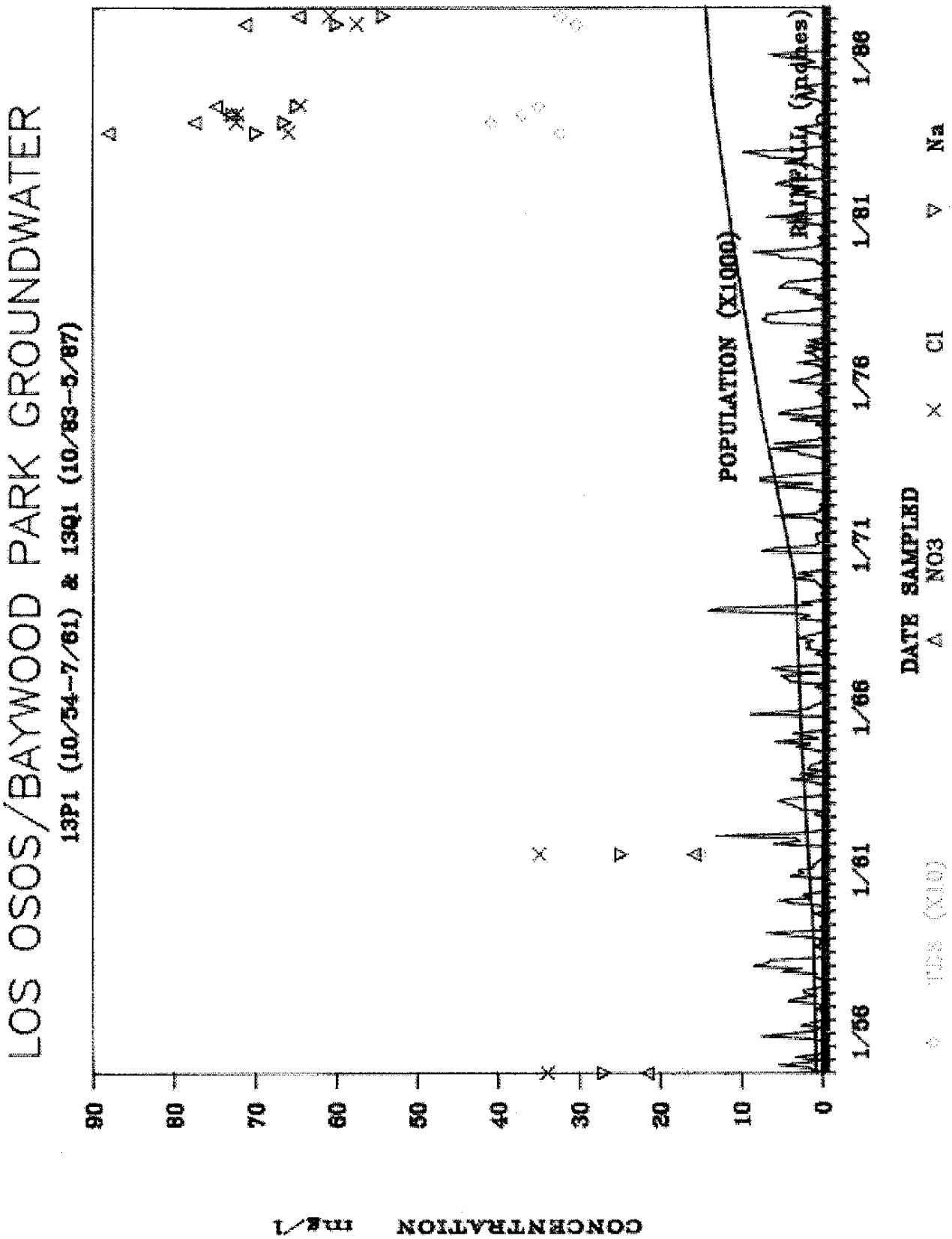

LOS OSOS/BAYWOOD PARK GROUNDWATER
13P1 (10/54-7/61) & 13W1 (10/83-5/87)
POPULATION (X1000)
RAINFALL (inches)
DATE SAMPLED
NO3
Cl
Na
CONCENTRATION mg/l
90
80
70
60
50
40
30
20
10
0
1/56
1/61
1/66
1/71
1/76
1/81
1/86

FIGURE 14

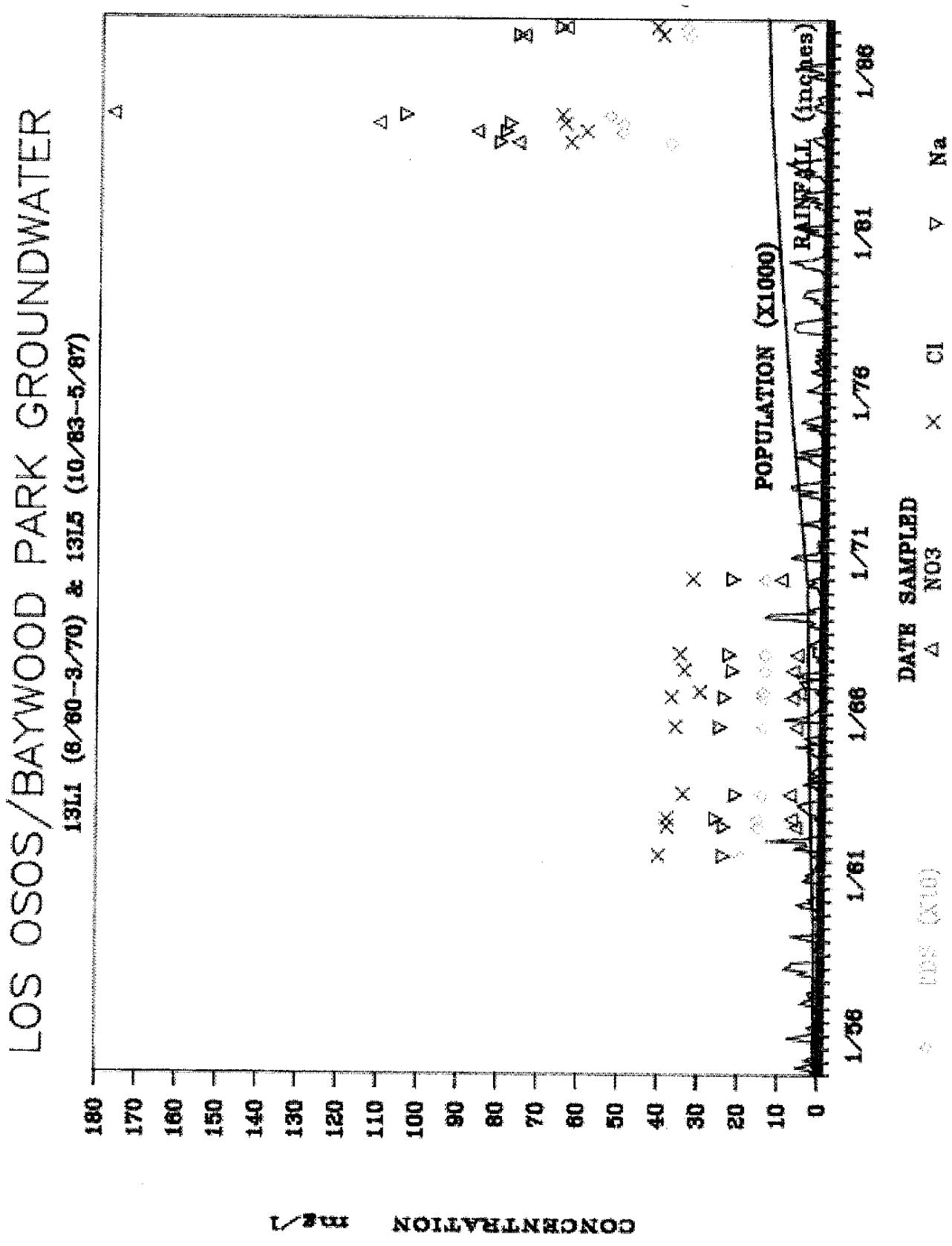

LOS OSOS/BAYWOOD PARK GROUNDWATER
13L1 (8/60-3/70) & 13L5 (10/83-5/87)
CONCENTRATION mg/l
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1/56
1/61
1/66
1/71
1/76
1/81
1/86
POPULATION (X1000)
RAINFALL (inches)
DATE SAMPLED
NO3
Cl
Na

FIGURE 15

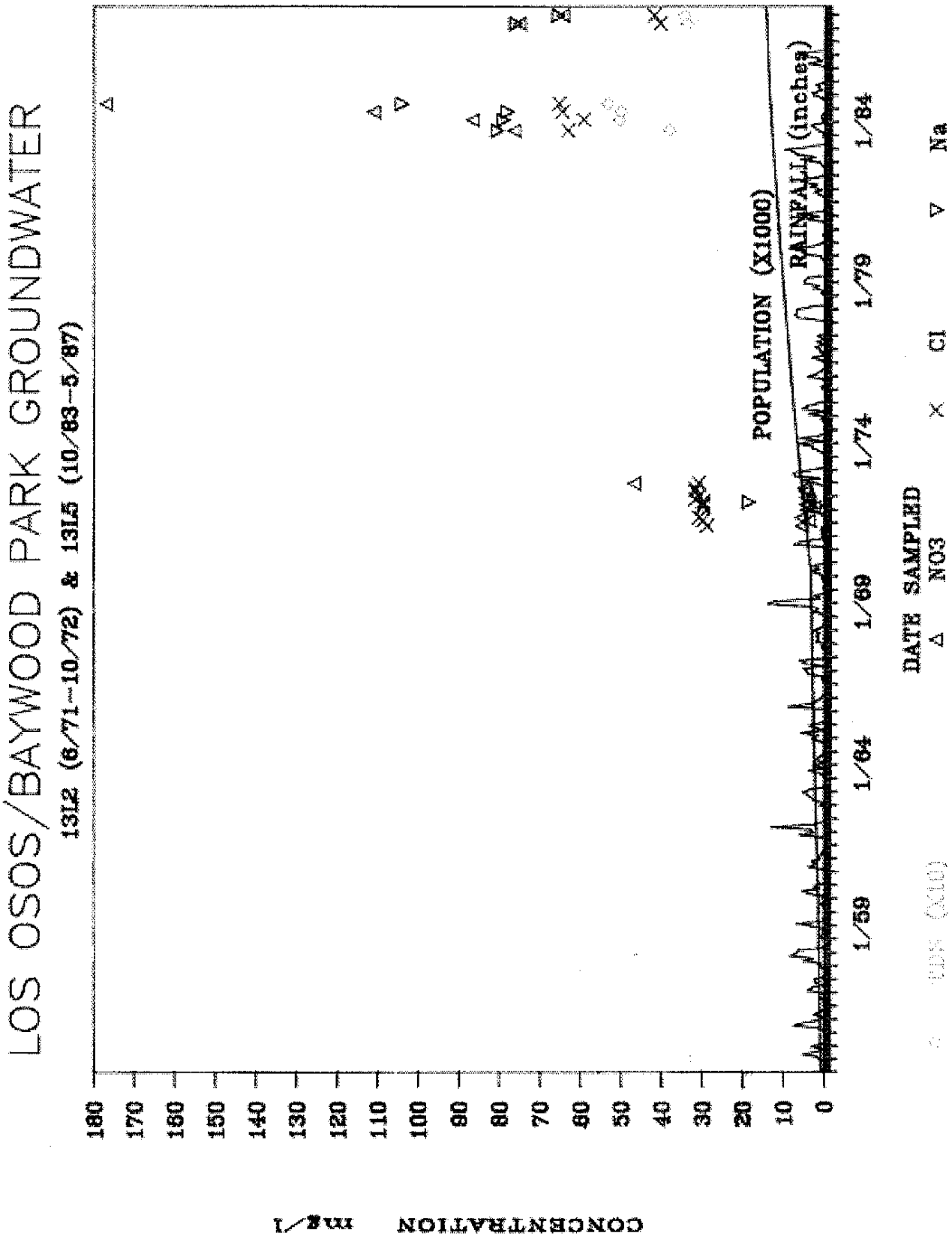

LOS OSOS/BAYWOOD PARK GROUNDWATER
1312 (6/71-10/72) & 1315 (10/83-5/87)
CONCENTRATION mg/l
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1/59
1/64
1/69
1/74
1/79
1/84
DATE SAMPLED
POPULATION (X1000)
RAINFALL (inches)
NO3
Cl
Na

FIGURE 16

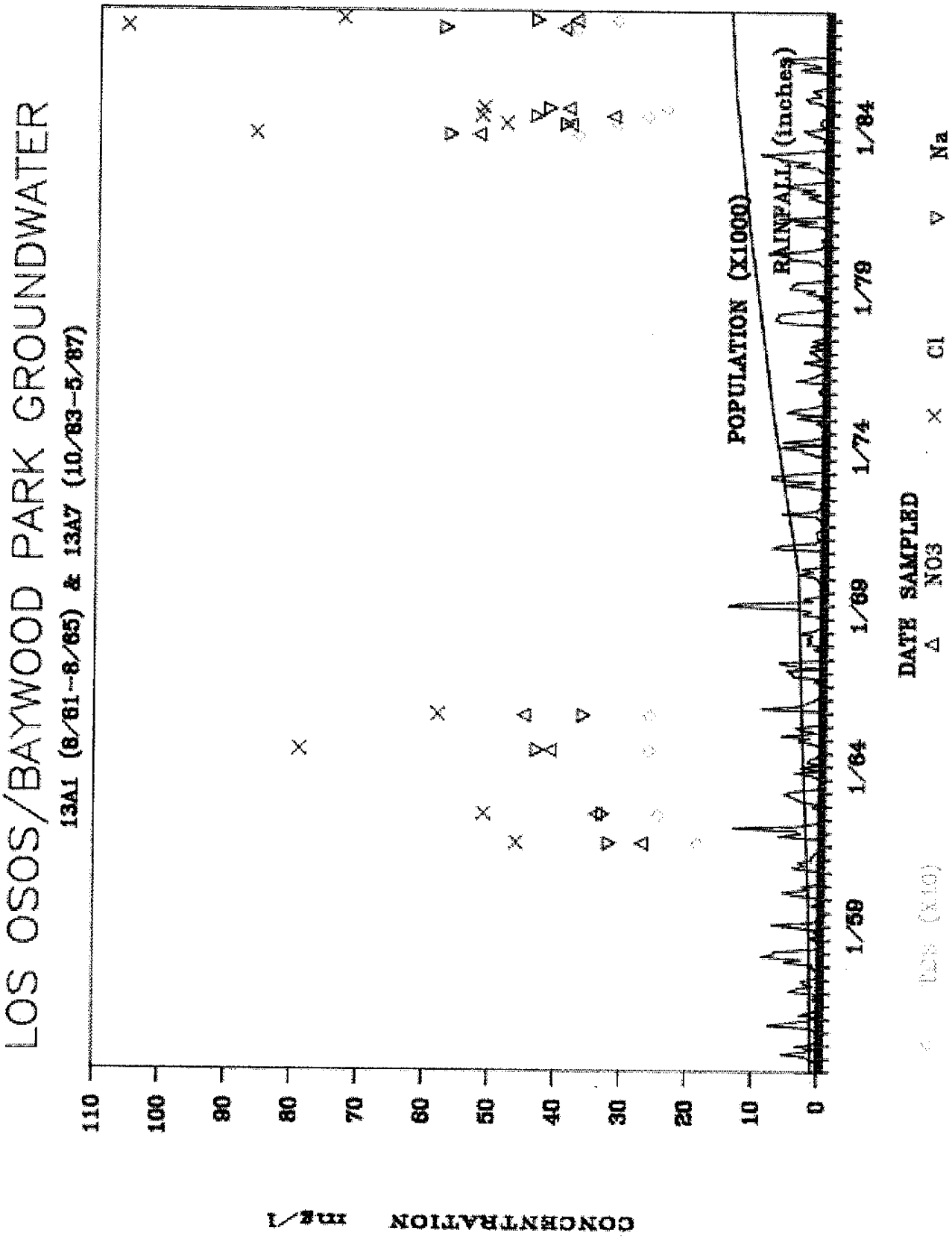

LOS OSOS/BAYWOOD PARK GROUNDWATER
13A1 (8/81-8/85) & 13A7 (10/83-5/87)
CONCENTRATION mg/l
110
100
90
80
70
60
50
40
30
20
10
0
POPULATION (X1000)
RAINFALL (inches)
1/59
1/64
1/69
1/74
1/79
1/84
DATE SAMPLED
NO3
Cl
Na

FIGURE 17

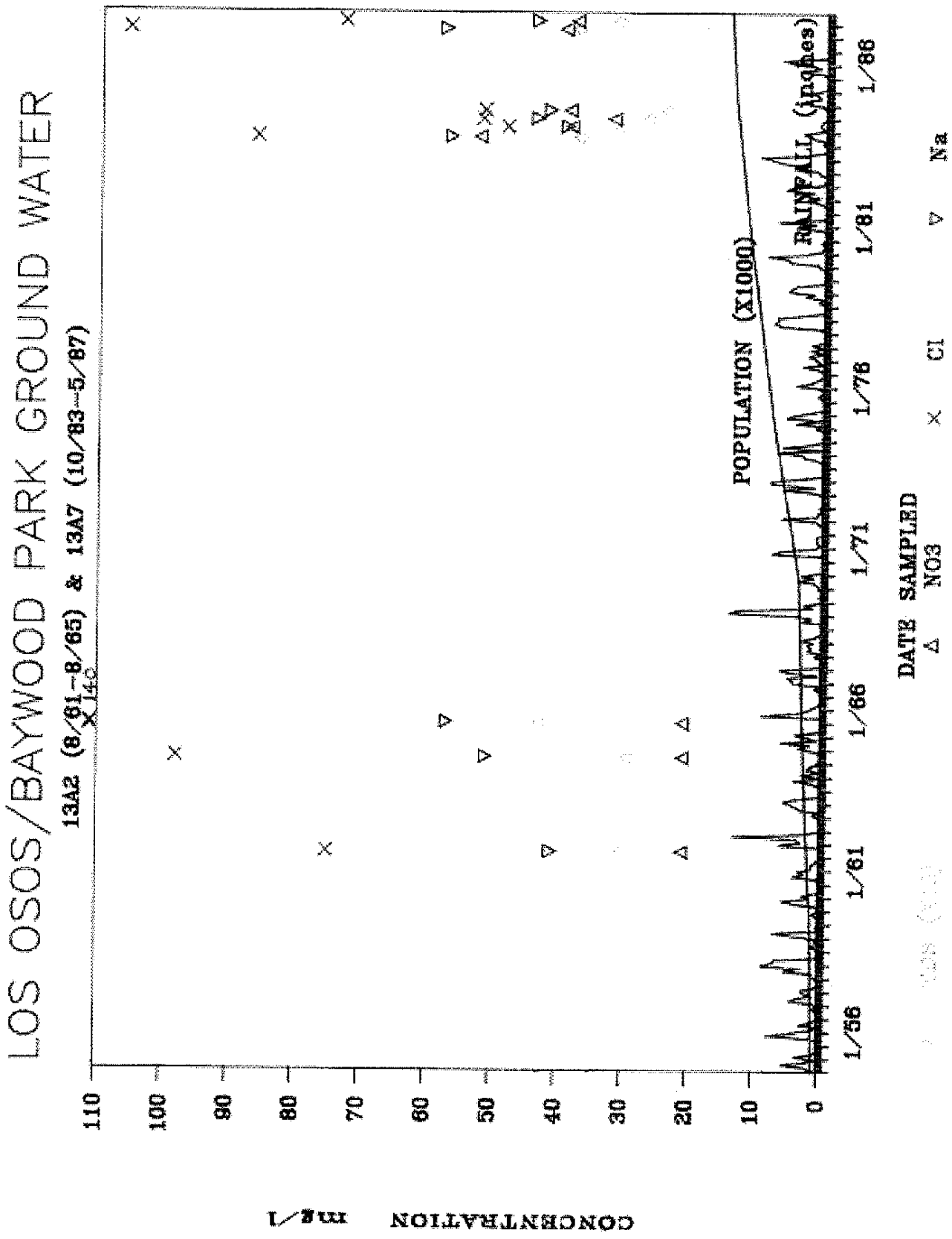

LOS OSOS/BAYWOOD PARK GROUND WATER
13A2 (8/61–8/65) & 13A7 (10/83–5/87)
X 140
110
100
90
80
70
60
50
40
30
20
10
0
1/56
1/61
1/66
1/71
1/76
1/81
1/86
POPULATION (X1000)
RAINFALL (inches)
DATE SAMPLED
NO3
Cl
Na
CONCENTRATION mg/l

FIGURE 18

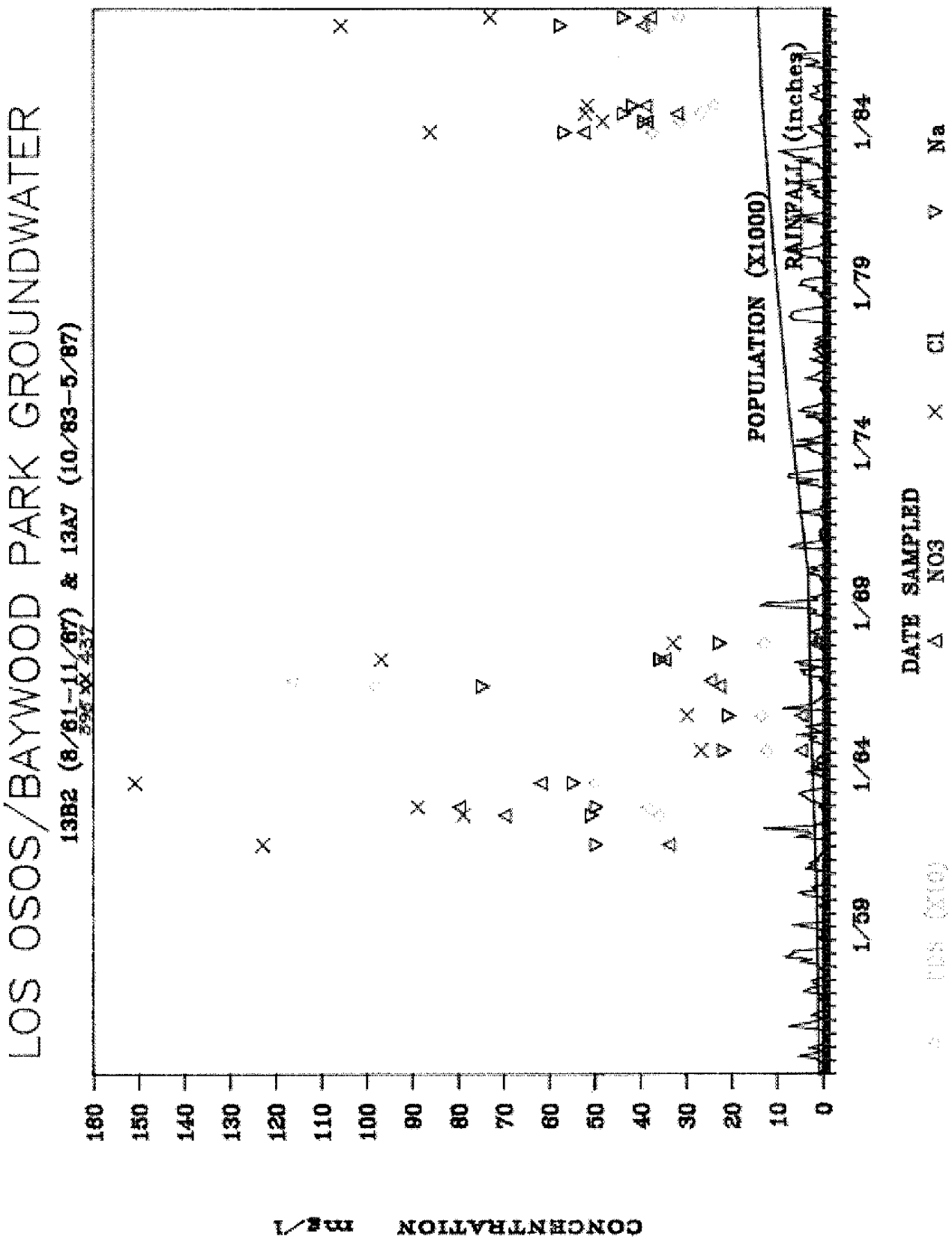

LOS OSOS/BAYWOOD PARK GROUNDWATER
13B2 (8/61-11/87) & 13A7 (10/83-5/87)
CONCENTRATION mg/l
180
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1/59
1/64
1/69
1/74
1/79
1/84
DATE SAMPLED
POPULATION (X1000)
RAINFALL (inches)
NO3
Cl
Na

FIGURE 20

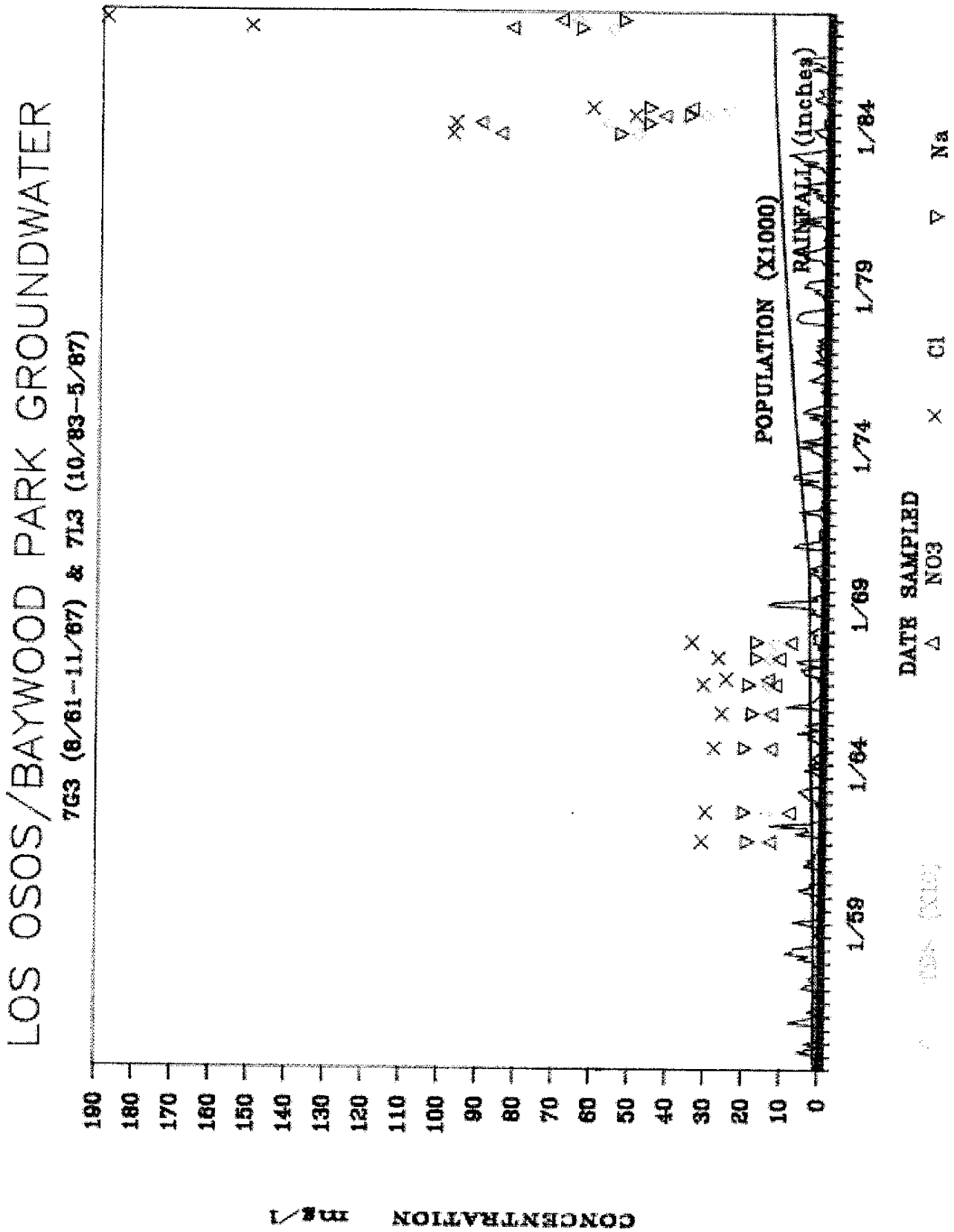

LOS OSOS/BAYWOOD PARK GROUNDWATER
7G3 (8/61-11/87) & 7L3 (10/83-5/87)
POPULATION (X1000)
RAINFALL (inches)
DATE SAMPLED
NO3
Cl
Na
CONCENTRATION mg/l
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1/59
1/64
1/69
1/74
1/79
1/84

FIGURE 21

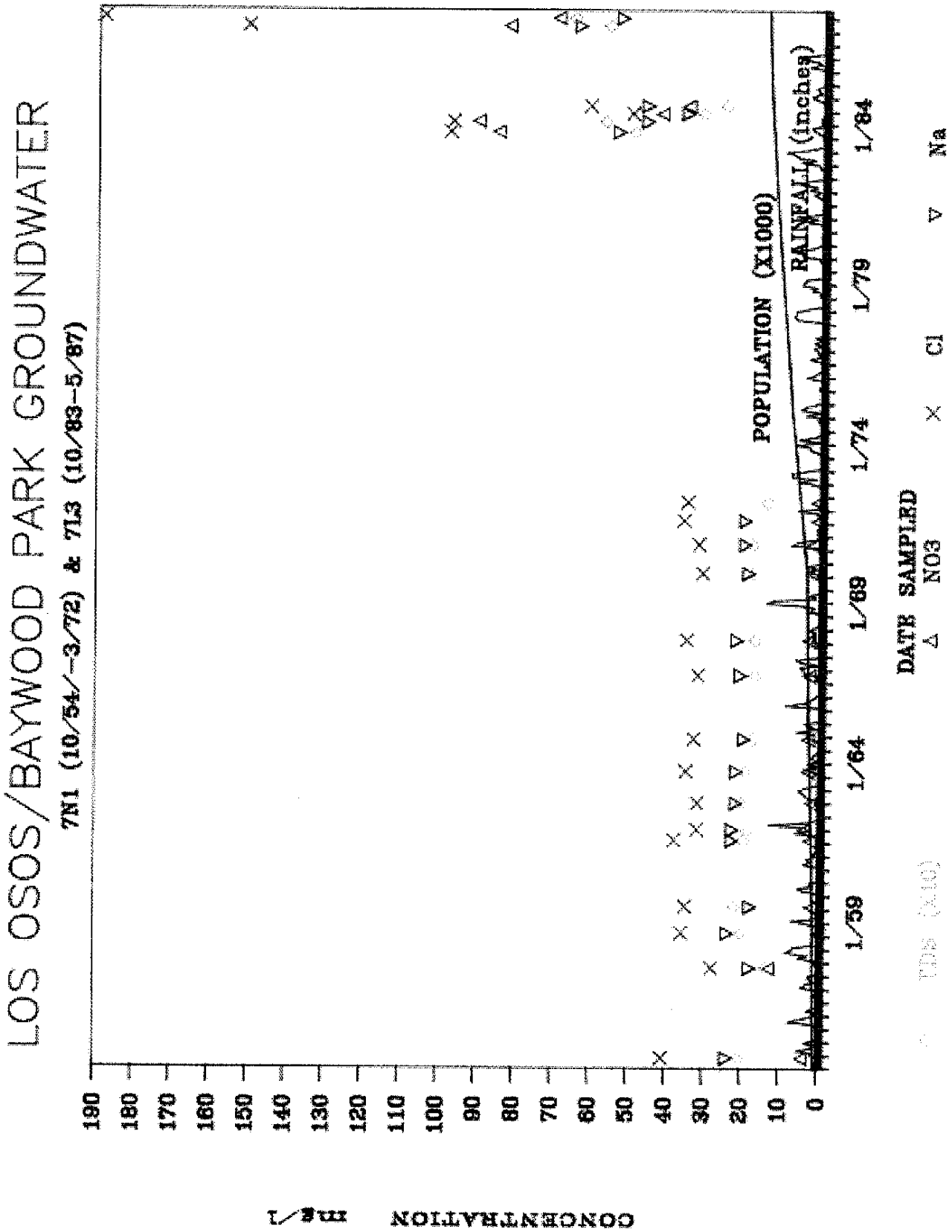

LOS OSOS/BAYWOOD PARK GROUNDWATER
7N1 (10/54/-3/72) & 7L3 (10/83-5/87)
CONCENTRATION mg/l
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1/59
1/64
1/69
1/74
1/79
1/84
DATE SAMPLED
POPULATION (X1000)
RAINFALL (inches)
NO3
Cl
Na

FIGURE 22

TABLES

TABLE 1 Well Perforation Depths

8/87 MJW

Well No.	Perforation Depth (ft.)	Perforation Elevation MSL #	Well Head Elevation MSL #
7L3	42-45	1, -2	43
7N1	61-83	-46, -68	15
7G3 *	62	-42	20
7Q1	29-75	-5, -51	24
13A7	30-40	-18, -28	10
13A1 *	30	-27	13
13A2 *	30	-12	18
13A6 *	20	-10	20
13B2 *	20	-15	5
13L5	32-35	-2, -5	30
13L1	80-140	-45, -105	35
13L2	100-140	-68, -108	32
13Q1	97-100	2, -1	99
13P1	115-135	-40, -60	75
13L1	80-140	-45, -105	35
13L2	100-140	-68, -108	32
18R1	40-50	129, 119	169
18Q1	78-86	64, 54	140
18J6	22-25	101, 98	123
18H1	112-231	50, -69	162
17F4	48-72	28, 4	76
21D3	125-140	-55, -70	70
21D4	40-140	28, -92	68
21E1	140-143	-66, -69	74

* Bottom depth of casing was all that was availab
# Mean Sea Level (ft.)

TABLE 2 Water Quality Data

FJD/MJW (Note: The TDS values are based on Electrical Conductivity multiplied by 0.7
8/87 The NO3 values, for 10/83-5/87, are NO3 as N times 4.43)

DATE		6/54	10/54	8/57	9/58	7/59	12/59	8/60	9/60	6/61	7/61
POPULATION		891	918	1188	1311	1414	1469	1619	1639	1817	1837
RAINFALL, in			0	0	1.17	0	0.57	0	0	0	0
WELL #		CONSTITUENTS, mg/l									
30S/10E	TDS		170.8								149.1
	NO3		21.7								16
13P1	Cl		34								35
	Na		27								25
30S/11E	TDS		208.6	136.5	203	221.2					
	NO3		4.3	13	0	2					
7N1	Cl		41	28	36	35					
	Na		24	18	24	18					
7Q1	TDS						132.3	182			
	NO3						1.3	5.3			
	Cl						30	31			
	Na						19	43			
8R1	TDS									889	
	NO3									2.7	
	Cl									100	
	Na									69	
18H1	TDS						144.9	157.5			147
	NO3						2	18			20
	Cl						32	33			34
	Na						22	23			19
18Q1	TDS	147		149.1	203	191.8			204.4		
	NO3	8.7		11	26	4			27		
	Cl	39		37	47	46			50		
	Na	23		23	30	25			29		

DATE		8/61	10/61	12/61	7/62	8/62	10/62	7/63	9/63	10/63	7/64	10/64	8/65	10/65
POPULATION		1857	1897	1936	2075	2095	2135	2313	2353	2373	2551	2611	2765	2793
RAINFALL, in		0	0	2.89	0	0	1.08	0	0.28	1.35	0	1.44	0	0
WELL #		CONSTITUENTS, mg/l												
30S10E	TDS	185.5			245						259		258.3	
	NO3	27			34						41		45	
13A1	Cl	46			51						79		58	
	Na	32			33						43		36	
13A2	TDS	303.8									294		428.4	
	NO3	21									21		21	
	Cl	75									98		140	
	Na	41									51		57	
13A6	TDS	335.3									210		130.2	
	NO3	53									42		2	
	Cl	66									46		27	
	Na	50									41		21	
13B2	TDS	343.7			360.5		384.3	500.5			126		137.2	
	NO3	44			70		80	62			8		8	
	Cl	123			79		89	151			27		30	
	Na	50			51		50	55			22		21	
13L1	TDS	194.6			154		154	142.8					139.3	
	NO3	0			6		7	7.4					6	
	Cl	40			38		38	34					36	
	Na	24			24		26	21					25	
23H1	TDS	260.4									126		240.8	
	NO3	3.6									7		12	
	Cl	61									41		56	
	Na	43									22		39	

30S11E	TDS	136.5			140						126		130.9	
7G3	NO3	13			8						13		13	
	Cl	31			30						28		26	
	Na	19			20						20		18	
7N1	TDS	197.4		186.9			203			193.2		175.7		
	NO3	2.3		3.9			2			3		3		
	Cl	38		32			32			35		33		
	Na	23		23			22			22		20		
7Q1	TDS	154					147.7							
	NO3	15					17							
	Cl	35					29							
	Na	21					20							
8R1	TDS				966		882	812						
	NO3				0		3	4.3						
	Cl				117		92	92						
	Na				74		74	75						
18H1	TDS						177.1							
	NO3						30							
	Cl						33							
	Na						25							
18R1	TDS												139	
	NO3												3	
	Cl												39	
	Na												21	
18Q1	TDS		161.7				203		210			196		210
	NO3		27				30		35			26		24
	Cl		46				42		43			44		50
	Na		23				31		35			29		35

DATE		7/66	9/66	10/66	1/67	5/67	11/67	12/69	3/70	11/70	5/71	6/71	8/71
POPULATION		2915	2942	2956	2997	3051	3133	3473	3624	4173	4584	4652	4789
RAINFALL, in		0.18	0.91	0	5.21	0.21	2.14	1.21	3.09	7.7	0.98	0	0
WELL #		CONSTITUENTS, mg/l											
30S/10E	TDS	983.5	1162			336.7	130.9						
13B2	NO3	23	25			35	2						
	Cl	395	437			97	33						
	Na	75				36	23						
13L1	TDS	141.4	142.1			137.2	138.6		135.8				
	NO3	7	5.4			7	6		10				
	Cl	37	30			34	35		32				
	Na	24				22	23		22				
13L2	TDS												
	NO3											5.8	3.9
	Cl											29	30
	Na												
23H1	TDS								487.2				
	NO3								5				
	Cl								28				
	Na								11				
30S/11E	TDS	135.8	138.6			133	119.7						
7G3	NO3	12	14			11	8						
	Cl	31	25			27	34						
	Na	19				17	17						
7N1	TDS			169.4			169.4	175.7		176.4			
	NO3			2.8			3	2		2			1.1
	Cl			32			35	31		32			36
	Na			21			22	19		20			20
7Q1	TDS		149.1				149.8	133.7	143.5		156.1		
	NO3		18				21	18	22		24	21	22
	Cl		30				34	29	32		31	31	33
	Na		20				21	18	20		22		
8R1	TDS	884.1	931			796.6	735.7						
	NO3	4	3.9			3.5	3						
	Cl	98	88			98	101						
	Na	68				81	72						

19H1	TDS		147.7				154	153.3	172.9				
	NO3		13				8	14	29			5.5	
	Cl		29				33	30	33			29	
	Na		21				17	20	24				
18B1	TDS		179.9				193.9	183.4					
	NO3		26				0	27					
	Cl		34				48	43					
	Na						31	26					
21E1	TDS								1068.				
	NO3								2				
	Cl								326				
	Na								97				

DATE		9/71	10/71	12/71	1/72	2/72	3/72	4/72	5/72	7/72	8/72	10/72	6/73
POPULATION		4858	4927	5064	5132	5201	5269	5338	5406	5544	5612	5749	6298
RAINFALL, in		0.1	0.55	6.1	0.86	0.53	0.03	0.44	0	0	0	2.08	0
WELL #		CONSTITUANTS, mg/l											
30S/10E	TDS												
	NO3	6			2.6	4.8	3.7	4.1	4.4	4.8	5.2	47	
13L2	Cl	31			30	30	30	32	31	32	32	31	
	Na						19						
30S/11E	TDS						140						
	NO3						1						
7N1	Cl						35						
	Na												
7B1	TDS						140						
	NO3	22	20	28	22	24	23	22	2.3	21	2.2	24	
	Cl	33	33	30	32	32	35	32	33	33	32	31	
	Na						18						
18H1	TDS						133						
	NO3						2						
	Cl						35						
	Na						23						
21D4	TDS												1009
	NO3												60.6
	Cl												103
	Na												63

DATE		10/83	2/84	5/84	8/84	2/87	5/87
POPULATION		13046	13234	13374	13515	14375	14452
RAINFALL, in		1.74	0.84	0	0.03		
WELL #		CONSTITUANTS, mg/l					
30S/10E	TDS	375.2	315.7	270.2	241.5	378.7	317
	NO3	52.71	38.80	32.29	39.11	39.87	38.1
13A7	Cl	86.4	48.5	52.3	52	106	73.3
	Na	57	39.5	44	42	57.9	44
13L5	TDS	383.6	506.1	502.6	534.8	340.9	347
	NO3	76.63	86.82	111.1	177.2	75.31	64.7
	Cl	63.4	59.5	64.8	65.6	40.7	42.2
	Na	81	79.5	78.5	104.5	76.5	66
13B1	TDS	324.1	409.5	371	351.4	304	324
	NO3	19.9	17.5	16.5	16.9	16.1	64.7
	Cl	66	72.4	72.3	64.5	57.6	60.9
	Na	70	66.5	73	65	60	54.3
30S/11E	TDS	495.6	573.3	316.4	256.2	563.5	655
	NO3	85.49	90.81	42.74	35.66	82.84	70
7L3	Cl	98.1	97.4	50.4	61.5	151	189
	Na	54	46.5	36	46.5	64.5	53.4
7N1	TDS	210	233	204	183		169
	NO3	11.2	12.8	6.38	9.3		7.5
	Cl	35.2	41.7	38.6	35		31.1
	Na	24.5	26	30.5	34		21.8

DATE		10/83	2/84	5/84	8/84	2/87	5/87
7B1	TDS	311.5	298.9	307.3	294	313.6	389
	NO3	48.73	53.16	60.69	55.37	62.02	61.1
	Cl	47.4	51	41.7	47.1	42.5	49.7
	Na	43.5	43.5	43	47	47.2	50
17F4	TDS	459.9	0	462.7	356.3	371.7	358
	NO3	19.40	1.506	0	1.816	10.63	19
	Cl	94.5	88.2	79.5	80.8	71.1	82
	Na	61.5	60.5	55.5	60.5	64.3	60.2
18J6	TDS	829.5	421.4	385.7	333.2	336.7	367
	NO3	6.069	6.024	5.537	11.91	21.26	15.1
	Cl	196.5	42.9	45.1	49.9	61.5	49.7
	Na	168	58.5	58	54.5	51.7	49.6
18R1	TDS	256.2	287	258.3	240.8	240.8	255
	NO3	52.71	48.50	58.91	60.69	66.45	59.8
	Cl	57.8	42.2	41.9	40	35.4	39.8
	Na	43.5	36.5	41	39.5	40.7	35.1
18B1	TDS	242	204	210	191		198
	NO3	6.93	0.09	0	0		0
	Cl	59.9	87.4	64.8	76.1		82
	Na	30.5	45	27.5	37		31
21D3	TDS	885.5	0	840.7	763.7	665.7	
	NO3	99.67	71.32	101.8	83.72	78.85	
	Cl	116	86.1	82.4	57.7	49.2	
	Na	60.5	51	50	70	46.7	

STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

STAFF REPORT FOR REGULAR MEETING OF MAY 4-5, 2011
Prepared on April 8, 2011

ITEM NUMBER: **13**

SUBJECT: **Waste Discharge Requirements for the County of San Luis Obispo, Los Osos Water Recycling Facilities, San Luis Obispo County (Order No. R3-2011-0001)**

STAFF CONTACT: **David LaCaro 805/549-3892 or dlacaro@waterboards.ca.gov**

KEY INFORMATION

Facility Name	Los Osos Water Recycling Facility
Facility Owner:	County of San Luis Obispo
Location:	2300 Los Osos Valley Road, Los Osos, CA 93402
Discharge Type:	Municipal/Domestic
Design Capacity:	1.2 MGD Annual Average
Treatment Type:	Extended Aeration with Tertiary Filtration
Disposal:	Leachfield, urban reuse, and agricultural reuse
Recycling:	Future plans, but Discharger has not yet developed Engineering Report
This Action:	**Adopt Order No. R3-2011-0001**

SUMMARY

The County of San Luis Obispo (County) proposes to construct a wastewater collection, treatment, disposal and recycling system to serve the communities of Los Osos and Baywood Park. The Los Osos Water Recycling Facility (WRF) is intended to replace individual septic system and thereby result in residents' compliance with an onsite wastewater system prohibition set forth in Resolution No. 83-13 found in the Water Quality Control Plan (Basin Plan) for the Central Coast Region. The proposed Waste Discharge Requirements Order (Order) is specific to the treatment, disposal, and reuse of wastewater at the Los Osos WRF.

PURPOSE

The design and construction of the wastewater treatment system for the community of Los Osos has been a controversial issue for nearly three decades. Acting with authority granted by AB 2701[1], the County plans to design and construct a community-wide wastewater treatment facility capable of 1) addressing the current water quality issues, 2) allowing an opportunity for urban and agricultural water reuse, and 3) providing a major step in water balance in the Los Osos groundwater basin. The County is eager to obtain waste discharge requirements from the Central Coast Water Board as such requirements will facilitate funding from the State Water Board and allow final design work on the wastewater collection, treatment, disposal and recycling facilities.

[1] ftp://leginfo.public.ca.gov/pub/05-06/bill/asm/ab_2701-2750/ab_2701_bill_20060920_chaptered.pdf

Associates Los Osos Nitrate Monitoring Program concluded that "water quality trends are interpreted to indicate the general mineral concentrations in shallow groundwater are close to equilibrium conditions under the current land uses and septic discharges, which have been relatively stable since the 1980's," this equilibrium is a state of contamination. Data in Tables 3, 4, and 5 of the Cleath and Associates report indicate wells with nitrate concentrations above the drinking water standard. Therefore, current land use and septic discharges, even at equilibrium, yield an exceedance of nitrate in some wells, which does not comply with water quality standards.

3. "Concerns about the potential for surfacing septic system effluent or seeps to the estuary threatening resources and human health can be addressed with a much smaller decentralized project, integrated with septic system and storm water management plans. Further, purveyors are planning to treat upper aquifer water for nitrates before delivery."

Staff Response 34: The proposed Order establishes discharge requirements for a project proposed by the county after years of alternatives study and after adoption of an EIR that identifies the impacts of the proposed and alternative projects. Further evaluation of alternatives is not appropriate in this forum. That purveyors have to treat water before service is a result of septic system use, and the responsibility for that contamination fairly resides with the Dischargers of the waste, not the users of the water (even though in this case the users are in most cases also Dischargers). See also Staff Response 35.

4. "Well-head treatment of nitrates in Los Osos is more cost-effective than treating nitrates with a wastewater project. Property owners should not have to pay twice for treating the water nor should they have to pay for the most costly option."

Staff Response 35: Discharge of waste to waters of the state is a privilege, not a right, and if such discharges degrade water quality, the Water Board has the responsibility to require corrective action. Abandonment of the aquifer to continual pollution is not an option. Staff agrees that well-head treatment in combination with the construction and operation of the LOWRF, local water conservation, water production management, and recycled water reuse will facilitate a reduction of nitrate concentrations in the upper aquifer. No changes are proposed.

Ms. Piper Reilly – Ms Reilly submitted comments (quite some time ago) primarily regarding exfiltration, infiltration, dewatering for the collections lines, and seawater intrusion. Staff has reviewed these comments and offers the following responses.

1. "Gravity collection is far more problematic and hazardous than low pressure collection. With over twenty thousand joints, in these Baywood fine sands, on multiple fault lines, leakage is probable even with proper maintenance. Such leakage would be hard to detect and harder to find the exact location of no less reach when the depths of these large diameter pipes can be more than 20 feet."

Staff Reponses 36: See staff response 28. No changes are proposed.

2. "I could not find the costs and impacts of sea/ground water infiltration into the gravity sewer line. Such infiltration will adversely impact beneficial reuse, sea water intrusion mitigation, and crop irrigation. These critical issues are of primary concern to the Coastal Commission in their upcoming de novo hearing on the LOWWP. Sea water contains approximately 35,000 mg/L Total Dissolved Solids including approximately

ANGEL LAW Law Offices of Frank P. Angel

2601 Ocean Park Blvd., Suite 205
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Tel: (310) 314-6433
Fax: (310) 314-6434

April 18, 2011

REQUEST UNDER THE CALIFORNIA PUBLIC RECORDS ACT

Ms. Kristin Murillo and Ms. Sallie Ashton
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

Via U.S. Mail & Email to kmurillo@waterboards.ca.gov & sashton@waterboards.ca.gov

Re: Writings Related to the Los Osos Wastewater Project, the Los Osos Valley Water Basin, and the Morro Bay National Estuary

Dear Ms. Murillo and Ms. Ashton:

Pursuant to Government Code sections 6253 and 6253.1, part of the California Public Records Act (PRA), we request, on behalf of our client Citizens for a Sustainable Community, full and accurate copies of the public records specified under paragraphs 1 through 20 below. For purposes of compliance with this PRA request, please consider the definition of the terms "public records" and "writing" as set forth in Government Code section 6252.[1]

PUBLIC RECORDS REQUESTED:

1. All writings (including staff reports, memoranda, emails, text messages and notes or transcripts of meetings and telephone communications) prepared by or for the State Water Resources Control Board, including all staff members (collectively, SWRCB), since April 1, 2010, regarding the following:

[1] For your convenience, a copy of the text of Government Code section 6252 is attached as exhibit 1 to this request.

(a) The Los Osos Wastewater Project (LOWWP);
(b) The Los Osos Valley Water Basin;
(c) The Morro Bay National Estuary; and
(d) The Petition for Action filed by Mr. Keith Wimer and Ms. Elaine Watson, dated April 1, 2010, entitled "Petition: Central Coast Regional Board's failure to act on seawater intrusion in the Los Osos Valley" (Petition of K. Wimer and E. Watson).

2. All writings (including memoranda, emails, text messages and notes of meetings or telephone communications) evidencing any communication between the SWRCB and the Central Coast Regional Water Quality Control Board, including all staff members and officials, since April 1, 2010, regarding the following:

(a) The LOWWP;
(b) The Los Osos Valley Water Basin;
(c) The Morro Bay National Estuary; and
(d) The Petition of K. Wimer and E. Watson.

3. All writings (including memoranda, emails, text messages and notes of meetings or telephone communications) evidencing any communication between the SWRCB and the County of San Luis Obispo, including all San Luis Obispo County staff members and officials, since April 1, 2010, regarding the following:

(a) The LOWWP;
(b) The Los Osos Valley Water Basin;
(c) The Morro Bay National Estuary; and
(d) The Petition of K. Wimer and E. Watson.

4. All writings (including memoranda, emails, text messages and notes of meetings or telephone communications) evidencing any communication between the SWRCB and any consultants retained by or advising the County (including The Wallace Group, Cleath-Harris Associates, Stetson Engineers, Eugene and Maddaus Water Management), since April 1, 2010, regarding the following:

(a) The LOWWP;
(b) The Los Osos Valley Water Basin;
(c) The Morro Bay National Estuary; and
(d) The Petition of K. Wimer and E. Watson.

5. All writings (including memoranda, emails, text messages and notes of meetings or telephone communications) evidencing any communication between the SWRCB and the

Los Osos Community Services District, including all Los Osos Community Services District (LOCSD) employees and officials, since April 1, 2010, regarding the following:

(a) The LOWWP;
(b) The Los Osos Valley Water Basin;
(c) The Morro Bay National Estuary; and
(d) The Petition of K. Wimer and E. Watson.

6. All writings (including memoranda, emails, text messages and notes of meetings or telephone communications) evidencing any communication between the SWRCB and any consultants retained by or advising LOCSD (including The Wallace Group, Cleath-Harris Associates, Stetson Engineers, Eugene and Maddaus Water Management), since April 1, 2010, regarding the following:

(a) The LOWWP;
(b) The Los Osos Valley Water Basin;
(c) The Morro Bay National Estuary; and
(d) The Petition of K. Wimer and E. Watson.

7. All writings (including memoranda, emails, text messages and notes of meetings or telephone communications) evidencing any communication between the SWRCB and the Golden State Water Company, including all Golden State Water Company employees and officials, since April 1, 2010, regarding the following:

(a) The LOWWP;
(b) The Los Osos Valley Water Basin;
(c) The Morro Bay National Estuary; and
(d) The Petition of K. Wimer and E. Watson.

8. All writings (including memoranda, emails, text messages and notes of meetings or telephone communications) evidencing any communication between the SWRCB and any consultants retained by or advising Golden State Water Company (including The Wallace Group, Cleath-Harris Associates, Stetson Engineers, Eugene and Maddaus Water Management), since April 1, 2010, regarding the following:

(a) The LOWWP;
(b) The Los Osos Valley Water Basin;
(c) The Morro Bay National Estuary; and
(d) The Petition of K. Wimer and E. Watson.

9. All writings (including memoranda, emails, text messages and notes of meetings or telephone communications) evidencing any communication between the SWRCB and the S

& T Mutual Water Company, including all S & T Mutual Water Company employees and officials, since April 1, 2010, regarding the following:

(a) The LOWWP;
(b) The Los Osos Valley Water Basin;
(c) The Morro Bay National Estuary; and
(d) The Petition of K. Wimer and E. Watson.

10. All writings (including memoranda, emails, text messages and notes of meetings or telephone communications) evidencing any communication between the SWRCB and any consultants retained by or advising S & T Mutual Water company (including The Wallace Group, Cleath-Harris Associates, Stetson Engineers, Eugene and Maddaus Water Management), since April 1, 2010, regarding the following:

(a) The LOWWP;
(b) The Los Osos Valley Water Basin;
(c) The Morro Bay National Estuary; and
(d) The Petition of K. Wimer and E. Watson.

11. All writings (including memoranda, emails, text messages and notes of meetings or telephone communications) evidencing any communication between the SWRCB and the Morro Bay National Estuary Program, including all Morro Bay National Estuary Program employees and officials, since January 1, 2010, regarding the following:

(a) The LOWWP;
(b) The Los Osos Valley Water Basin;
(c) The Morro Bay National Estuary; and
(d) The Petition of K. Wimer and E. Watson.

12. All writings (including memoranda, emails, text messages and notes of meetings or telephone communications) evidencing any communication between the SWRCB and the San Luis Obispo Science and Ecosystems Alliance, including all San Luis Obispo Science and Ecosystems Alliance employees and officials, since January 1, 2010, regarding the following:

(a) The LOWWP;
(b) The Los Osos Valley Water Basin;
(c) The Morro Bay National Estuary; and
(d) The Petition of K. Wimer and E. Watson.

13. All writings evidencing all data sets and samplings, investigations, analyses, reports, tests, assessments and evaluations relating to the water quality and water supply

(including any information relating to seawater intrusion) in the Los Osos Valley Water Basin generated, prepared, owned, received or used by the SWRCB since January 1, 2010, excluding the information in the administrative record of *Prohibition Zone Legal Defense Fund v. Regional Water Quality Control Board, Central Coast Region* (Super. Ct. San Luis Obispo County, No. CV 070472).

14. All writings evidencing all data sets and samplings, investigations, analyses, reports, tests, assessments and evaluations relating to the water quality of Morro Bay National Estuary (including any information relating to septic system contamination) generated, prepared, owned, received or used by the SWRCB since January 1, 2010, excluding any information from the administrative record of *Prohibition Zone Legal Defense Fund v. Regional Water Quality Control Board, Central Coast Region* (Super. Ct. San Luis Obispo County, No. CV 070472).

15. All writings evidencing contamination or harm to the Morro Bay National Estuary, estuarine systems or other waters in the vicinity of Los Osos (e.g., Los Osos Creek, Los Osos Creek Estuary, Willow Creek, Eto Lake, Sweet Spring, Baywood Marsh) caused by septic systems, excluding any information from the administrative record of *Prohibition Zone Legal Defense Fund v. Regional Water Quality Control Board, Central Coast Region* (Super. Ct. San Luis Obispo County, No. CV 070472).

16. All writings evidencing harm (or claims of harm) to any specific natural person in contact with the waters of the Morro Bay National Estuary or estuarine systems in the vicinity of Los Osos (e.g., Los Osos Creek, Los Osos Creek Estuary, Willow Creek, Eto Lake, Sweet Spring, Baywood Marsh) caused by septic systems, excluding any information from the administrative record of *Prohibition Zone Legal Defense Fund v. Regional Water Quality Control Board, Central Coast Region* (Super. Ct. San Luis Obispo County, No. CV 070472).

17. All writings evidencing nitrate treatment processes other than treatment with wastewater projects that the SWRCB recognizes as viable or effective, including any writings explaining why those processes are viable or effective, or are considered by the SWRCB to be viable or effective.

18. All writings evidencing all nitrate reduction programs or strategies the SWRCB has been recommending or suggesting for implementation or use within urban and suburban areas which do not involve development of infrastructure or operation of a centralized wastewater project, including any documented results of any such programs.

19. All writings evidencing all wastewater treatment projects funded or approved by the SWRCB in which the SWRCB has required review or development of an alternative project

or modification of the proposed project to reduce socio-economic impacts or make the project more cost-effective.

20. All writings evidencing any decision by the SWRCB in which a waste discharge requirement, effluent limitation, or water quality limitation has been waived for an applicant due to the economic infeasibility of any such requirement or limitation, or because the benefits did not justify or outweigh social or economic adverse impacts.

We request delivery of copies of the requested writings, along with a determination and notification of disclosable public records, as mandated by Government Code section 6253, subdivision (c), no later ten (10) days from this request. We request such copies without waiving our client's right to inspect the writings at the SWRCB's offices. To expedite production of the writings and reduce cost, please feel free to forward via email attachment to the undersigned at jelhajj@angellaw.com, any writings stored in electronic format, in the e-format the SWRCB uses for its public records, or the e-format in which the SWRCB received requested writings from persons outside the SWRCB.

Please note that the term "writing" includes "any form of communication," i.e., communications such as faxes, emails and text messages, and the record created by any such form of communication, "regardless of the manner in which the record has been stored." (Gov. Code, § 6252, subd. (g).) Please further note that so long as emails or text messages relate to the conduct of the public's business, they are public records within the meaning of the PRA, regardless of whether they are being sent or received through a person's official state email account or personal email account, transit through public agency servers, or are stored on state government network drives. " 'Public records,' " indeed, "includes any writing containing information relating to the conduct of the public's business" whether it is "prepared, owned, used, *or* retained" by the SWRCB, "regardless of physical form or characteristics." (Gov. Code, § 6252, subd. (e), emphasis added.) We thus request that, as the SWRCB's custodians of records, you take all necessary steps to ensure that all electronically stored information relating to government business (i.e., the public's business), responsive to this PRA request, be protected against alteration or deletion (Gov. Code, § 6253, subd. (d)) and collected in an orderly fashion; and that all responsive information which the SWRCB and its public officials and employees are required by state law to preserve and retain, be produced.

Thank you for your assistance. Please call for any questions concerning this request.

ANGEL LAW

Jeff El-Hajj

EXHIBIT 1

Public Resources Code section 6252:

"As used in this chapter:

"(a) 'Local agency' includes a county; city, whether general law or chartered; city and county; school district; municipal corporation; district; political subdivision; or any board, commission or agency thereof; other local public agency; or entities that are legislative bodies of a local agency pursuant to subdivisions (c) and (d) of Section 54952.

"(b) 'Member of the public' means any person, except a member, agent, officer, or employee of a federal, state, or local agency acting within the scope of his or her membership, agency, office, or employment.

"(c) 'Person' includes any natural person, corporation, partnership, limited liability company, firm, or association.

"(d) 'Public agency' means any state or local agency.

"(e) 'Public records' includes any writing containing information relating to the conduct of the public's business prepared, owned, used, or retained by any state or local agency regardless of physical form or characteristics. "Public records" in the custody of, or maintained by, the Governor's office means any writing prepared on or after January 6, 1975.

"(f) 'State agency' means every state office, officer, department, division, bureau, board, and commission or other state body or agency, except those agencies provided for in Article IV (except Section 20 thereof) or Article VI of the California Constitution.

"(g) 'Writing' means any handwriting, typewriting, printing, photostating, photographing, photocopying, transmitting by electronic mail or facsimile, and every other means of recording upon any tangible thing any form of communication or representation, including letters, words, pictures, sounds, or symbols, or combinations thereof, and any record thereby created, regardless of the manner in which the record has been stored."

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February 26, 2011

State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

Via E-Mail to Charles R. Hoppin, Chair (smacali@waterboards.ca.gov)
Frances Spivy-Weber, Vice Chair (Ldouglas@waterboards.ca.gov)
Tam M. Doduc (Dbourgeois@waterboards.ca.gov)
Dwight P. Russell (Ldouglas@waterboards.ca.gov)

Re: Objections to Approval of Funding from the Clean Water State Revolving Fund for the Los Osos Wastewater Project (CWRSF Project No. C-06-5230)

Honorable Board Members:

We submit these comments on behalf of our client, Citizens for a Sustainable Community (Citizens), for consideration by the State Water Resources Control Board (SWRCB) in deciding whether to approve funding in the amount of $86,208,416 from the Clean Water State Revolving Fund (CWSRF) for the Los Osos wastewater project (LOWWP), a project proposed by the County of San Luis Obispo (County). For the reasons summarized below and further explained in the attached addendum and exhibits, we request that *before* the SWRCB takes any action approving the County's application for this funding, it order preparation and public circulation of a subsequent or supplemental environmental impact report (SEIR), and consider the information in that SEIR. Such a course of action is mandated by the California Environmental Quality Act (CEQA) (Pub. Res. Code § 21000 et seq.) and the State CEQA Guidelines (Guidelines) (Cal. Code Regs., tit. 14, § 15000 et seq.), among other things, due to new information of substantial importance that was not known -- indeed, did not exist -- and could not reasonably have been known and considered

when the County, acting as lead agency, prepared and certified the environmental impact report (EIR) for the LOWWP.[1]

Alternatively, should the SWRCB not wish to conduct SEIR review, or commit to any further environmental review, it should deny the County's funding application outright. (See § 21080, subd. (b)(5).) Because for purposes of approving the requested CWSRF project financing, the SWRCB is a "responsible agency" within the meaning of CEQA, it may indeed "refuse to approve" the requested funding "to avoid direct or indirect environmental effects of that part of the project which [as the] responsible agency [it is] called on to carry out or approve." (Guidelines, § 15042.) In fact, because when new information of substantial importance has come light CEQA *requires* preparation of an SEIR, approval of the funding without an SEIR would be a prejudicial abuse of discretion under CEQA. Whenever an agency with discretionary approval authority over a permit, funding or another entitlement for use for a project makes an approval decision, and the final EIR for the project fails to provide the environmental information disclosure mandated by CEQA, or is not supplemented to add significant new environmental information relevant to the project, the decision is a prejudicial abuse of discretion, and, therefore, a nullity. (See *Communities for a Better Environment v. City of Richmond* (2010) 184 Cal.App.4th 70, 88 [an agency's " 'ultimate decision of whether to approve a project, be that decision right or wrong, is a nullity if based upon an EIR that does not provide the decision-makers, and the public, with the information about the project that is required by CEQA' "]; *Mira Monte Homeowners Assn. v. County of Ventura* (1985) 165 Cal.App.3d 357, 361, 364-365 [failure to prepare an SEIR after resurvey of project site revealed significant new information (i.e., a greater seasonal wetlands impact than previously shown) vitiated approval decision because it prevented consideration of "the full range and effectiveness of alternatives and mitigation measures"].) Thus, unless on March 1, 2011, the SWRCB continues the matter to allow for preparation of an SEIR, it must deny the County's funding application.

Because the SWRCB has discretionary approval power over funding from the State Revolving Fund, the SWRCB is a "responsible agency" within the meaning of CEQA for the purpose of environmental review of the County's funding application. (Guidelines, § 15381; see also § 21069.) "An activity … supported, in whole or in part, through contracts, grants, subsidies, loans, or other forms of assistance" is subject to CEQA review. (§ 21065, subd. (b).) Also, since the CWSRF loan program receives federal funding via the U.S. Environmental Protection Agency, federal environmental review requirements, such as assessment under the Endangered Species Act of 1973 (16 U.S.C. § 1531 et seq.) of a SWRCB funding decision's impacts on federally listed species, must be followed as well *before* that decision is made.

As a responsible agency, the SWRCB must reach its own conclusions on whether and how to approve a project, based on a review of the previously prepared environmental documents and any new information in a new environmental document the SWRCB may have to prepare. (Guidelines, §§ 15020, 15052, 15096, subd. (a), 15162, 15163.) As discussed in greater detail in the attached addendum, Guidelines section 15052 requires the SWRCB to step into the shoes of the County, and prepare (or contract preparation of) an SEIR prior to approving CWSRF funding for the LOWWP because: (1) the prerequisites under § 21166 and Guidelines section 15162 for an SEIR

[1] All unlabeled section (§) references in this letter are to the Public Resources Code.

are established; and (2) prior to the SWRCB's action, the lead agency (County) granted a final discretionary approval for the LOWWP and the statute of limitations for challenging that approval has expired. (County approval occurred on September 29, 2009. The statute of limitations expired in fall 2009 -- 30 days after the posting of the County's notice of determination which gave public notice of the September 29, 2009 decision.)

Section 21166 and Guidelines sections 15162 and 15163 require the preparation of an SEIR when (1) substantial changes occur with respect to the circumstances under which a project is undertaken, such that revisions of the EIR are necessary due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects; or (2) new information of substantial importance which was not known and could not have been known with the exercise of reasonable diligence when the EIR was certified becomes available, showing that: (i) the project will have one or more significant effects not discussed in the EIR; (ii) significant effects previously examined will be substantially more severe than shown in the EIR; (iii) mitigation measures or alternatives previously found infeasible would in fact be feasible and would substantially reduce one or more significant effects of the project; or (iv) mitigation measures or alternatives considerably different from those analyzed in the previous EIR would substantially reduce one or more significant effects on the environment.

As summarized next, substantial changes in physical baseline conditions under which the LOWWP is undertaken have occurred and new information has become available, meeting the criteria of § 21166 and Guidelines section 15162:

► The Los Osos Basin Plan Update publicly released in May 2010 by an interagency working group consisting of representatives from the County and the area's three major water purveyors (over seven months after certification of the EIR) shows rapidly accelerating seawater intrusion into the Los Osos Valley groundwater basin, the region's only drinking water source. Additional independent expert review of the Plan Update by Mr. Eugene Yates, a hydrogeologist, now confirms that accelerating seawater intrusion into the basin is an "extremely urgent" problem requiring urgent action, including 500 AFY of reduced pumping from the urban compartment. Yates also recommended the review of a wide range of mitigation options to address changes in basin conditions, adding that the LOWWP, in conjunction with the increased pumping from the upper aquifer may induce seawater intrusion in the upper aquifer. Yates opined that accelerating seawater intrusion may make the LOWWP's recycled water reuse program -- viewed as key mitigation for the LOWWP -- nonviable.

Given these new circumstances and new information, CEQA requires, prior to any CWSRF funding commitment for the LOWWP, SEIR review of (1) the significantly increased saltwater movement into the basin -- a major change in physical baseline conditions affecting groundwater sustainability; and (2) the relationship of this change to -- including the cumulative effects of this change on -- the changes in aquifer dynamics and freshwater storage that result from the implementation of the LOWWP, as designed and approved, which ends groundwater recharge through decommissioning of the onsite wastewater disposal systems. SEIR assessment crucial to informed decisionmaking on the seawater intrusion impacts of the LOWWP and the comparative impacts of feasible wastewater treatment alternatives must be performed, and mitigation measures correlated to the actual severity of the impact (the real, anticipated salinity levels and their

distribution) must be developed and implemented, based on specific, measurable, enforceable and verifiable performance standards.

► As correctly observed in the SWRCB's staff report for the March 1, 2011 meeting, the U.S. Fish and Wildlife Service is currently revising the Biological Opinion (BiOp) it prepared for the LOWWP in order to conduct an analysis of the significant effects that habitat restoration mitigation ordered by the California Coastal Commission after certification of the final EIR at the "Midtown" site may have on the federally endangered Morro shoulderband snail. (SWRCB staff report at 3.) A "potential substantial impact on [an] endangered, rare or threatened species is per se significant[.]" (*Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 449 [citing Guidelines, § 15065, subd. (a)(1)].) Analysis of the newly disclosed impacts on the Morro shoulderband snail was not, and could not have been, conducted in the 2009 County EIR. The habitat restoration was imposed on the LOWWP by the Coastal Commission in 2010, as a condition for the issuance of the coastal development permit for the LOWWP. Without an SEIR integrating and reviewing the information from the as-yet to be completed revised BiOp, the SWRCB cannot assess the LOWWP's impacts on the Morro shoulderband snail and any recommended mitigations for those impacts. Failure to conduct such an assessment before the March 1, 2011 funding decision will violate CEQA. (*Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 449; see also *Portland Audubon Society v. Babbitt* (9th Cir. 1993) 998 F.2d 705, 708-709 [failure to prepare supplemental EIS despite new information showing significant effects on endangered owls held arbitrary and capricious].) The SWRCB cannot jump the gun on this impact simply by including "as a special condition" of its funding decision or financing agreement with the County "Compliance with all terms and conditions of the final USFWS Biological Opinion…." (Staff report at 4.) "[A] mitigation measure cannot be used as a device to avoid disclosing project impacts. [Citation.]" (*San Joaquin Raptor Rescue Center v. County of Merced* (2007) 149 Cal.App.4th 645, 663-664.)

Importantly, even absent -- but especially because of the presence of -- the new physical baseline conditions and the new information summarized above, the SWRCB, as a responsible agency, must mitigate or avoid "the direct or indirect environmental effects of those parts of the project which it decides to carry out, finance, or approve." (Guidelines, § 15096, subd. (g)(1).) Also, "When an EIR has been prepared for a project, the Responsible Agency shall not approve the project as proposed if the agency finds any feasible alternative or feasible mitigation measures within its powers that would substantially lessen or avoid any significant effect the project would have on the environment." (Guidelines, § 15096, subd. (g)(2).) Finally, before approving the CWSRF loan agreement, the SWRCB must "make the findings required by [Guidelines] Section 15091 for each significant effect of the project and shall make the findings in [Guidelines] section 15093 if necessary." (Guidelines, § 15096, subd. (h); see *Save San Francisco Bay Assn. v. San Francisco Bay Conservation and Development Com.* (1992) 10 Cal.App.4th 908, 932; see *id*. at 921-922 [responsible agency must "conduct its own analysis using its own special expertise" before "reach[ing] its own conclusions"].)

The discretionary approval currently before the SWRCB involves almost half of the funding for the LOWWP. (Staff report at 5.) Since this funding is not tied to specific elements of the LOWWP, the SWRCB has a duty to mitigate or avoid the adverse impacts of the project as a whole. While the SWRCB's proposed resolution contains findings related to the LOWWP's significant impacts to

farmland (draft SWRCB resolution at 1 (¶¶ 9-10), it contains no findings concerning any other significant effect of the project, or potentially feasible alternatives or mitigation measures which the SWRCB can impose as a condition of its funding approval, which would avoid or substantially lessen the LOWWP's significant effects.

In any event, given the new physical baseline conditions and the new information available following certification of the 2009 final EIR for the LOWWP, the SWRCB must do more than prepare findings tracking the requirements of Guidelines section 15096, subdivision (h). It must prepare and circulate an SEIR, and explore and impose (following public review of the SEIR) feasible alternatives or mitigation measures to the LOWWP as proposed. Whatever bureaucratic or political County momentum there may be behind the LOWWP, the next responsible agency must follow the law. It cannot simply defer to the lead agency without assuming its own duties under CEQA, including its duties under section 21166 and Guidelines sections 15052, 15162 and 15096.

In sum, we request that the issues presented above and those identified in our addendum and supporting attachments be fully aired and resolved through SEIR review. We adopt and incorporate by reference all additional grounds for CEQA compliance that may have been presented to the SWRCB, or may be presented to it, before it takes action on the County's funding application. An SEIR should consider in-depth reasonable alternatives, including a septic tank effluent pumping (**STEP**) system or other alternatives and mitigation measures avoiding or minimizing the environmental impacts of the LOWP as currently proposed, while demanding substantially less public funding. Reduced costs are beneficial to the residents of Los Osos and the State Revolving Fund. Project alternatives that will establish basin sustainability with much less risk to natural resources and to state and federal loans, are environmentally and fiscally preferable.

ANGEL LAW

Frank P. Angel

Enclosures

cc: Thomas Howard, Executive Director (NAquino@waterboards.ca.gov)
Jim Maughan, Assistant Deputy Director, Division of Financial Assistance (jmaughan@waterboards.ca.gov)

Stanford Report, May 20, 2010

Stanford scientists confirm that polluted groundwater flows from coastal septic systems to the sea http://www.stanford.edu/group/knowledgebase/cgi-bin/2010/09/10/from-septic-system-to-the-sea-tracking-groundwater-pollution

Stanford University researchers have tracked a plume of polluted groundwater from a septic system to one of California's top recreational beaches. The results may be an important step in improving coastal wastewater management in the United States.

Courtesy of Nick de Sieyes

BY DANIEL STRAIN

Faulty septic systems have long been blamed for polluting some of California's most popular beaches. Yet few scientific studies have established a direct link between septic systems and coastal contamination.

Now, in the first study of its kind, Stanford University researchers have tracked a plume of polluted groundwater from a septic system to one of Northern California's top recreational beaches. The researchers say their findings could be an important step toward improving wastewater management in coastal communities throughout the United States.

"The flow of groundwater directly to the ocean is very hard to measure," said Alexandria Boehm, associate professor of civil and environmental engineering at Stanford. "We hope that this work will raise awareness of the importance of groundwater as a source of pollution, and that coastal communities will look at this source when considering conservation efforts."

Since 2008, Boehm and her Stanford colleagues have been studying the flow of groundwater from a large septic system at Stinson Beach, a favorite destination of swimmers and surfers about 20 miles north of San Francisco that's managed by the National Park Service. The study is supported by an Environmental Venture Projects grant from Stanford's Woods Institute for the Environment.

Stinson Beach is relatively clean compared with other California coastal sites, such as Malibu and Rincon Beach, where high levels of bacterial contamination have been blamed on failing septic systems. Efforts in these communities to make the costly switch to sewer-based plumbing have proved contentious.

At Stinson Beach, the Stanford team has worked closely with local and federal agencies to educate the public on the pros and cons of septic systems and develop a consensus on how to improve groundwater quality.

Groundwater pollution

In septic systems, wastewater drains from toilets and sinks into an underground tank, then through porous pipes in a leach field, where surrounding sand filters out bacteria and other pathogens. Microbes in the dirt break down organic and inorganic wastes, such as nitrogen.

"In conventional septic systems, wastewater treatment tends to be inefficient for certain contaminants," said Nick de Sieyes, an engineering graduate student working with Boehm. "As a result, untreated sewage can end up polluting nearby groundwater."

Prior to this study, scientists had never observed in detail a plume of contaminated groundwater flowing from a septic system to the sea. To track groundwater pollution at Stinson Beach, the research team obtained a permit from the National Park Service to install a network of 120 monitoring wells near a large septic system close to a beach parking lot that collects wastewater from nearby homes and public toilets.

The wells were placed in parallel rows on the beach separating the septic system from the ocean – a distance of several hundred yards. This network of wells allowed researchers to collect groundwater samples and assess the degree of contamination flowing from the septic system through the beach and out to sea.

Mixed results

The results were encouraging in one respect, de Sieyes said. Tests revealed low concentrations of fecal indicator bacteria – microbes that are used by health officials to evaluate water quality for beach closures.

"The septic system appeared to be treating fecal indicator bacteria to a relatively high degree, so the chance of triggering a water-quality advisory in the surf zone during our study was low," he said.

Although few microbes made it out of the leach field alive, the scientists discovered a plume of nitrogen-enriched groundwater flowing through the sand toward the ocean. Studies have shown that excess nitrogen can cause harmful blooms of phytoplankton and other algae that choke off oxygen in coastal waters.

In previous experiments at Stinson Beach, Boehm and her colleagues recorded a spike in phytoplankton following a period of nitrogen-rich groundwater discharge. And in subsequent laboratory experiments, Stinson Beach groundwater proved to be a good meal for algae.

"In the lab, we induced small phytoplankton blooms in ocean water by adding just a little bit of fresh groundwater from this site," de Sieyes explained. "In communities like Stinson Beach, whatever doesn't get treated in the beach is ultimately going to flow into the ocean."

Fixing the plumbing

Many California communities have switched to conventional sewer systems as an alternative for treating wastewater. But septic-to-sewer conversions are pricey and encourage development, Boehm said. Wastewater plants are also energy hogs, de Sieyes added.

"Because septic systems rely on naturally occurring bacteria in the ground to do the cleaning, they're much more energy efficient," he said.

But septic system technology hasn't evolved much since the 1950s, Boehm added, so new systems may have to be designed to treat wastewater to a higher degree before it is discharged to a leach field.

"If there was a better, cheaper, more efficient onsite treatment technology, I'm sure the Stinson Beach community would be interested in it," de Sieyes said.

The research team has presented its findings to the National Park Service and at public meetings, and it has worked closely with the Stinson Beach County Water District. Even before the study began, the water district had taken big steps to green its shores, de Sieyes said, by establishing eco-friendly rules for installing new septic systems, including restrictions on how close to shore they can be built.

"The local water district and the community as a whole deserve a great deal of credit for tackling this issue head on," he said.

"Our results will provide valuable insight into the fate and transport of contaminants from septic systems along the California coastline and elsewhere," Boehm said. "Predicting where, when and what magnitude of environmental pollution can be expected will help guide regulators in deciding which coastal settings are appropriate for septic systems."

Other Stanford collaborators on the Environmental Venture Projects grant are law Professor Deborah Sivas and Woods Institute Senior Fellows Scott Fendorf, professor of environmental Earth system science, and Rosemary Knight, professor of geophysics.

Daniel Strain is a science-writing intern at the Woods Institute for the Environment at Stanford University.

Daily news email

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Woods Institute for the Environment

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Media Contact

Mark Shwartz, Woods Institute for the Environment: (650) 723-9296, mshwartz@stanford.edu

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STATE WATER RESOURCES CONTROL BOARD
BOARD MEETING SESSION - DIVISION OF WATER QUALITY
FEBRUARY 15, 2011

ITEM 6

SUBJECT

CONSIDERATION OF A RESOLUTION APPROVING AN AMENDMENT TO THE WATER QUALITY CONTROL PLAN FOR THE CENTRAL COAST REGION (BASIN PLAN) TO: (1) REMOVE THE SHELLFISH HARVESTING BENEFICIAL USE FOR SAN LORENZO RIVER ESTUARY; (2) ADD THE SAN LORENZO RIVER WATERSHED TO THE HUMAN FECAL MATERIAL DISCHARGE PROHIBITION AND THE DOMESTIC ANIMAL WASTE DISCHARGE PROHIBITION; AND (3) ESTABLISH TOTAL MAXIMUM DAILY LOADS FOR PATHOGENS IN SAN LORENZO RIVER ESTUARY, SAN LORENZO RIVER, BRANCIFORTE CREEK, CAMP EVERS CREEK, CARBONERA CREEK, AND LOMPICO CREEK

DISCUSSION

On May 8, 2009, the Central Coast Regional Water Quality Control Board (Central Coast Water Board) adopted Resolution No. R3-2009-0023 (Attachment) amending the Basin Plan to: (1) remove the Shellfish Harvesting (SHELL) beneficial use for San Lorenzo River Estuary; (2) add the San Lorenzo River Watershed to the Human Fecal Material Discharge Prohibition and the Domestic Animal Waste Discharge Prohibition; and (3) establish Total Maximum Daily Loads (TMDLs) for pathogens in San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Camp Evers Creek, Carbonera Creek, and Lompico Creek (San Lorenzo Watershed).

SHELL Removal

The first part of this amendment removes the SHELL beneficial use for the San Lorenzo River Estuary. Central Coast Water Board staff completed a Use Attainability Analysis in which it determined that the SHELL beneficial use designation for the San Lorenzo River Estuary is not an existing use and is not attainable. Factors that preclude the attainment of the use include hydrological modifications, natural flow conditions, and physical conditions related to the natural features of the water body as well as evidence that neither historic (since 1975) nor current shellfish harvesting has occurred. Central Coast Water Board staff state that, in addition to the factors that preclude attainment of the SHELL beneficial use, San Lorenzo Estuary appears to have been originally designated inappropriately without a thorough scientific basis. The SHELL removal was scientifically peer-reviewed, and the reviewer agreed with the Central Coast Water Board staff's assessment.

Impairment

The San Lorenzo Estuary, San Lorenzo River, Branciforte Creek, Carbonera Creek, and Lompico Creek were listed on the 2010 Integrated Report, Clean Water Act (CWA) section 303(d) list of water quality limited segments (List) because they did not meet water quality standards as demonstrated by elevated pathogen indicator levels. Camp Evers Creek is not on the List, but is also impaired because fecal coliform concentrations exceed water quality objectives. Because San Lorenzo Estuary (referred to on the List as the "San Lorenzo River Lagoon"), San Lorenzo River, Branciforte Creek, Carbonera Creek, and Lompico Creek are

listed, CWA section 303(d) requires the establishment of a TMDL. TMDLs are also authorized under CWA section 303(d)(3) for waters not on the List, and a TMDL can constitute a plan of implementation under Water Code section 13242. As a result, a TMDL was also developed for Camp Evers Creek. A TMDL specifies load allocations for nonpoint sources and wasteload allocations for point sources that, when implemented, are expected to result in attainment of applicable water quality standards. Since these TMDLs are being established as a Basin Plan amendment, state law requires an implementation plan and schedule to ensure that the TMDLs are achieved.

The amendment addresses the pathogen impairment of the San Lorenzo River Watershed by establishing TMDLs and applying two prohibitions to the watershed. The water quality objectives in the Basin Plan are set at established levels of indicator bacteria, in this case fecal coliform, that demonstrate the presence of fecal pollution. Indicator organisms such as these have long been used to protect bathers from illnesses that may be contracted during recreational activities in surface waters contaminated by fecal pollution. These organisms often do not cause illness directly, but are good indicators of the existence of harmful pathogens. Current fecal coliform concentrations in the San Lorenzo River Watershed exceed the existing Basin Plan numeric water quality objectives for protecting the Water Contact Recreation beneficial use.

Sources

Pathogen indicator organism sources include natural sources; sanitary sewer collection system leaks and spills (including but not limited to discharges from municipal sanitary sewer collection systems and private laterals connected to municipal sanitary sewer collection systems); storm drain discharges from municipally owned and operated separate storm sewer systems (MS4s) which are permitted under a National Pollutant Discharge Elimination System (NPDES) permit; onsite wastewater treatment system discharges; pet waste in areas that do not drain to MS4s; homeless person/encampment discharges in areas that do not drain to MS4s; and farm animal/livestock discharges.

Targets and TMDL Allocations

The amendment establishes a numeric target equal to the Basin Plan water quality objectives for the protection of the water contact recreation beneficial use. The numeric target used to develop the TMDLs is:

Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 most probable number (MPN) per 100 milliliters (mL), nor shall more than 10 percent of samples collected during any 30-day period exceed 400 MPN per 100 mL.

Responsible parties are assigned one of two possible allocations. Responsible parties are either assigned an allocation equal to the numeric target or an allocation of zero. The allocation of zero or no loading is assigned to responsible parties whose discharge would include untreated human waste and thus pose a greater health risk than most bacteria of other origins.

The responsible parties that were given the allocations equal to the TMDLs' target include the MS4s covered by an NPDES permit, owners/operators of land used for/containing pets, and owners/operators of land used for/containing farm animals and livestock. The responsible party for each of these sources must not discharge or release a load of fecal coliform that will

increase the concentration above the assimilative capacity of a water body. All responsible parties for sources of fecal coliform to the San Lorenzo River Watershed will be accountable to attain these allocations. Under the TMDLs, parties that have been assigned allocations are not responsible for natural (uncontrollable) sources. Responsible parties may demonstrate that although water quality objectives are not being achieved in receiving waters, controllable sources of pathogens are not contributing to the exceedance.

Responsible parties that must comply with the Human Fecal Material Discharge Prohibition are assigned a waste load allocation of zero; no discharge of fecal coliform bacteria load originating from human sources is allowed. These responsible parties include the City of Santa Cruz and the City of Scotts Valley for sources from spills or leaks of the sewer collection system, owners of private laterals responsible for sources from spills or leaks, owners/operators of land that include homeless persons/encampments, and onsite wastewater treatment system discharges. An implicit margin of safety has been incorporated in the TMDLs through conservative assumptions.

Prohibitions

The amendment adds the San Lorenzo River Watershed onto the list of areas that are covered by two Basin Plan prohibitions. The two Basin Plan prohibitions are the Domestic Animal Waste Discharge Prohibition and the Human Fecal Material Discharge Prohibition. The Domestic Animal Waste Discharge Prohibition is intended to address pet, farm animal, and livestock discharges in areas that do not drain to MS4s. The Human Fecal Material Discharge Prohibition is intended to address spills and leaks from the sanitary sewer collection systems, private sewer lateral leaks, onsite wastewater disposal system discharges, and discharges from land that includes homeless persons/encampments.

Implementation

The purpose of the implementation plan is to describe the steps necessary to reduce fecal coliform loads in order to achieve these TMDLs. The TMDLs require the Central Coast Water Board to address fecal indicator bacteria discharged from the County of Santa Cruz and the Cities of Santa Cruz and Scotts Valley MS4 entities by regulating them under the provisions of the State Water Board's General Permit for the Discharges of Storm Water from Small MS4s (General Permit) (NPDES No. CAS000004) and any subsequent iteration of the General Permit. As enrollees under the General Permit, the municipalities responsible for the MS4s must develop and implement a Storm Water Management Plan (SWMP) that controls urban runoff discharges into and from their storm water system. To address the MS4 entities' TMDL wasteload allocations, the TMDLs require the Central Coast Water Board to require the County of Santa Cruz and the Cities of Santa Cruz and Scotts Valley MS4 entities to specifically target fecal indicator bacteria in urban runoff through incorporation of a Wasteload Allocation Attainment Plan in their SWMPs.

The TMDLs require the Central Coast Water Board to use the Domestic Animal Waste Discharge Prohibition to address sources of fecal material from domestic animals that do not drain to the MS4s. Owners and/or operators of lands containing domestic animals in the San Lorenzo River Watershed must comply with the Domestic Animal Waste Discharge Prohibition. Compliance with the prohibition implies compliance with the load allocation for these TMDLs.

The entities with jurisdiction over the sewer collection systems in the San Lorenzo River Watershed are the Cities of Santa Cruz and Scotts Valley (Cities). The Cities must comply with

the Human Fecal Material Discharge Prohibition, thus their wasteload allocation for sewer system spills and leaks is zero. To comply with the Human Fecal Material Discharge Prohibition, the Cities must continue to implement their Collection System Management Plans, as required by their respective NPDES permits and Waste Discharge Requirements (WDRs). In addition, the City of Santa Cruz is required by its WDR to improve maintenance of its sewage collection system, including identification, correction, and prevention of sewage leaks in portions of the collection system that run through or adjacent to, impaired surface waters within the San Lorenzo River Watershed. Compliance with their NPDES permits and/or WDRs is intended to demonstrate compliance with their wasteload allocation and the Human Fecal Material Discharge Prohibition.

Individual owners and operators of private laterals to sanitary sewer collection systems are ultimately responsible for maintenance and are, therefore, responsible for complying with the Human Fecal Material Discharge Prohibition; compliance with the prohibition implies compliance with the applicable load allocations for these TMDLs. However, because leaks from private laterals located in the City of Santa Cruz results in a source of fecal indicator bacteria in the City of Santa Cruz storm water systems, enrollees for the City of Santa Cruz's General Permit will be required to address fecal indicator bacteria from private lateral leaks in its Wasteload Allocation Attainment Program, as required in its SWMP.

The TMDLs rely on the Human Fecal Material Discharge Prohibition to address discharges from homeless persons/encampments that do not drain to the MS4s. Owners of land with homeless persons must demonstrate to the satisfaction of the Executive Officer or the Central Coast Water Board that they are in compliance with the Human Fecal Material Discharge Prohibition; compliance with the prohibition implies compliance with the load allocation for these TMDLs. The Central Coast Water Board intends to identify properties with homeless encampments. Identified responsible parties are required to submit reports to the Central Coast Water Board. These responsible parties are required to submit a report documenting that measures are in place and effectively minimizing discharges or demonstrating that no discharge is occurring from homeless encampments.

The TMDLs rely on the Human Fecal Material Discharge Prohibition to address onsite wastewater disposal system discharges. Owners of onsite wastewater disposal systems must demonstrate to the satisfaction of the Executive Officer or the Central Coast Water Board that they are in compliance with the prohibition, unless it is determined that the County of Santa Cruz or other appropriate entity is making adequate progress towards implementing an approved Wastewater Management Plan, or similar implementation program controlling the waste loads from onsite wastewater disposal systems in the San Lorenzo River Watershed. Compliance with the prohibition implies compliance with the load allocation for these TMDLs.

Evaluation

The TMDLs require the Central Coast Water Board to perform a review of implementation actions and monitoring results every three years beginning three years after the TMDLs are approved by OAL. The Central Coast Water Board plans to use annual reports, nonpoint source pollution control implementation programs, monitoring reports and other available information, to review implementation progress toward achieving the allocations and the numeric target. The Central Coast Water Board plans to continue three-year reviews until the TMDLs are achieved. The target date to achieve the TMDLs is 13 years after the date of approval by OAL.

Cost Estimate

Most of the implementation actions, monitoring, and reporting costs are currently required under existing Water Board permits and requirements. However, costs for additional measures that may be required to implement these TMDLs have been estimated as follows: Additional pathogen-specific management measures for local agencies (City of Santa Cruz, Scotts Valley, and County of Santa Cruz) that are responsible for storm water management ranges from an estimated two to 15 percent increase to its annual program budget. Additional monitoring costs are estimated to be approximately $8,000 per year. The cost associated with repair of a leaking private lateral is estimated to be $5,000, and the cost to test for leaks in a private lateral is estimated to be approximately $1,000. The costs estimated for control of homeless person and encampment discharges include security guards at a wage of $20-45 per hour, portable waste facilities at $95 per month, and/or security fencing at a cost of $1500-1800 per 100 feet. For the control of livestock and domesticated animals, the measures could include barriers, bunkers, corrals, and professional stabling with upper estimates of $4,000 per mile, $15,000 per structure, $4,000 per gate, and $550 per month respectively. The costs estimated for control of pet waste discharges include bags that can be used to pick up waste and are available starting at approximately $2.50 to $4.50 per box. Central Coast Water Board staff concluded that existing actions being taken by City of Scotts and the County of Santa Cruz appear to adequately address correction of failing system discharges.

When the Central Coast Water Board adopted Resolution No. R3-2009-0008, the amendment to the Water Quality Control Plan for the Central Coast Basin to: (1) add Total Maximum Daily Loads for fecal coliform in the Pajaro River Watershed; (2) add a Domestic Animal Waste Discharge Prohibition; and (3) add a Human Fecal Material Discharge Prohibition, it identified in the Basin Plan the estimated costs and potential sources of financing for the Domestic Animal Waste Discharge Prohibition as required under section 13141 of the Water Code. Those costs and potential sources of financing apply equally to the agricultural water quality control program in the San Lorenzo River Watershed.

POLICY ISSUE

Should the State Water Board approve the amendment to the Basin Plan to: (1) remove the SHELL beneficial use for San Lorenzo River Estuary; (2) add the San Lorenzo River Watershed to the Human Fecal Material Discharge Prohibition and the Domestic Animal Waste Discharge Prohibition; and (3) establish Total Maximum Daily Loads for pathogens in San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Camp Evers Creek, Carbonera Creek, and Lompico Creek?

FISCAL IMPACT

Central Coast Water Board and State Water Board staff work associated with or resulting from this action will be addressed with existing and future budgeted resources.

REGIONAL WATER BOARD IMPACT

Yes, approval of this resolution will amend the Central Coast Water Board’s Basin Plan.

STAFF RECOMMENDATION

That the State Water Board:

1. Approves the amendment to the Basin Plan adopted under Central Coast Water Board Resolution No. R3-2009-0023.

2. Authorizes the Executive Director or designee to submit the amendment adopted under Central Coast Water Board Resolution No. R3-2009-0023, as approved, and the administrative record for this action to OAL and the TMDLs and shellfish harvesting de-designation to the U.S. Environmental Protection Agency for approval.

State Water Board action on this item will assist the Water Boards in reaching Goal 1 of the Strategic Plan Update: 2008-2012 to implement strategies to fully support the beneficial uses for all 2006-listed water bodies by 2030. In particular, approval of this item will assist in fulfilling Action 1 to prepare, adopt, and take steps to carry out Total Maximum Daily Loads (TMDLs), designed to meet water quality standards, for all impaired water bodies on the 2006 list.

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 2011-

APPROVING AN AMENDMENT TO THE WATER QUALITY CONTROL PLAN FOR THE CENTRAL COAST REGION (BASIN PLAN) TO: (1) REMOVE THE SHELLFISH HARVESTING BENEFICIAL USE FOR SAN LORENZO RIVER ESTUARY, (2) ADD THE SAN LORENZO RIVER WATERSHED TO THE HUMAN FECAL MATERIAL DISCHARGE PROHIBITION AND THE DOMESTIC ANIMAL WASTE DISCHARGE PROHIBITION, AND (3) ESTABLISH TOTAL MAXIMUM DAILY LOADS FOR PATHOGENS IN SAN LORENZO RIVER ESTUARY, SAN LORENZO RIVER, BRANCIFORTE CREEK, CAMP EVERS CREEK, CARBONERA CREEK, AND LOMPICO CREEK

WHEREAS:

1. On May 8, 2009, the Central Coast Regional Water Quality Control Board (Central Coast Water Board) adopted Resolution No. R3-2009-0023 (Attachment I) amending the Basin Plan to: (1) remove the Shellfish Harvesting (SHELL) beneficial use for San Lorenzo River Estuary, (2) add the San Lorenzo River Watershed to the Human Fecal Material Discharge Prohibition and the Domestic Animal Waste Discharge Prohibition, and (3) establish Total Maximum Daily Loads (TMDLs) for pathogens in San Lorenzo River Watershed.

2. The federal regulations at 40 Code of Federal Regulations (CFR) section 131.10(g) allow the Central Coast Water Board to remove a designated use, which is not an “existing” use, if the state can demonstrate that achieving the use is not feasible based on the factors set forth in that section. Shellfish harvesting is not an “existing use” as that term is defined in 40 CFR section 131.3 because the shellfish harvesting use has not been attained in the water body on or after November 28, 1975. The removal of the SHELL beneficial use is based on the results of a Use Attainability Analysis (UAA) in the San Lorenzo River Estuary. Central Coast Water Board staff developed the UAA in 2004 and 2005 to determine the historic, actual, and potential shellfish harvesting activities in the San Lorenzo River Estuary. The UAA is necessary to conform to 40 CFR section 131.10(j) because the action involves a designated use specified in Clean Water Act (CWA) section 101(a)(2). The amendment and the UAA only address the fishable goal (“protection and propagation of fish, shellfish, and wildlife”) as it pertains to shellfish harvesting and does not address other fishable goals or the swimmable goal included in the water contact recreation designation contained in section 101(a)(2) of the CWA. The fishable goal of the CWA is also protected under other beneficial uses (including cold fresh water habitat) designated in the Basin Plan for the San Lorenzo River Estuary.

3. The Central Coast Water Board found that the removal of the shellfish harvesting beneficial use from the San Lorenzo River Estuary and the establishment of these TMDLs and Basin Plan amendments for the San Lorenzo River Watershed were consistent with the provisions of State Water Resources Control Board (State Water Board) Resolution No. 68-16, “Statement of Policy with Respect to Maintaining High Quality of Waters in California” and 40 CFR section 131.12.

4. The Central Coast Water Board may, pursuant to California Water Code section 13243, specify certain conditions or areas where the discharge of waste, or certain types of waste, will not be permitted (i.e., prohibitions). The Implementation Plan for the TMDLs for the San Lorenzo River Watershed requires compliance with the Human Fecal Material Discharge Prohibition and the Domestic Animal Waste Discharge Prohibition for discharges in the San Lorenzo River Watershed. Supporting documentation for adding the San Lorenzo River Watershed to the above-named prohibitions is provided in the Final Project Report for Total Maximum Daily Loads for Pathogens in San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Camp Evers Creek, Carbonera Creek, and Lompico Creek. Consistent with California Water Code section 13244, the Central Coast Water Board complied with public notice and hearing requirements for adding the San Lorenzo River Watershed to the Human Fecal Material Discharge and the Domestic Animal Waste Discharge Prohibitions.

5. The elements of a TMDL are described in 40 CFR sections 130.2 and 130.7 and section 303(d) of the CWA, and U.S. Environmental Protection Agency guidance documents. A TMDL is defined as "the sum of individual waste load allocations for point sources and load allocations for nonpoint sources and natural background" (40 CFR §130.2). The Central Coast Water Board has determined that the TMDLs for pathogens in the San Lorenzo River Watershed are set at levels necessary to attain and maintain the applicable numeric water quality objectives taking into account seasonal variations and any lack of knowledge concerning the relationship between effluent limitations and water quality (40 CFR §130.7(c)(1)). The regulations in 40 CFR section 130.7 also state that TMDLs shall take into account critical conditions for stream flow, loading, and water quality parameters. TMDLs are often expressed as a mass load of the pollutant but can be expressed as a unit of concentration if appropriate (40 CFR §130.2(i)). Expressing these TMDLs as units of concentration is appropriate in this case because an existing concentration-based water quality objective was used as the basis for determining the impairment, and the basis for the numeric targets in the TMDLs numeric target.

6. The Central Coast Water Board concurred with the Use Attainability Analysis and the analysis contained in the Final Project Report, the California Environmental Quality Act "Substitute Environmental Document" for the Basin Plan Amendments (including the CEQA Checklist), the staff report, responses to comments, and found that these analyses comply with the requirements of the State Water Board's certified regulatory CEQA process, as set forth in California Code of Regulations, Title 23, section 3775 et seq. Furthermore, the Central Coast Water Board found that these analyses fulfill the Central Coast Water Board's obligations attendant with the adoption of regulations "requiring the installation of pollution control equipment, or a performance standard or treatment requirement," as set forth in section 21159 of the Public Resources Code. The Central Coast Water Board's environmental analysis has taken into account a reasonable range of environmental, economic, and technical factors.

7. The State Water Board finds that the Basin Plan amendment is in conformance with Water Code section 13240, which specifies that Regional Water Quality Control Boards may revise Basin Plans; section 13242, which requires a program of implementation to achieve water quality objectives; and section 13243 which authorizes Regional Water Quality Control Boards to specify certain conditions or areas where the discharges of certain types of waste will not be permitted. The State Water Board also finds that the TMDLs, as reflected in the Basin Plan amendment, are consistent with the requirements of CWA section 303(d).

8. The regulatory action meets the "Necessity" standard of the Administrative Procedures Act, Government Code, section 11353, subd. (b). The necessity of developing a TMDL is established in the TMDLs staff report, the CWA section 303(d) List of Water Quality Limited Segments, and the data contained in the administrative record documenting the pathogen impairments of the San Lorenzo River Watershed.

9. A Basin Plan amendment does not become effective until approved by the State Water Board and until the regulatory provisions are approved by the Office of Administrative Law (OAL). The TMDLs and SHELL de-designation must also receive approval from the U.S. Environmental Protection Agency.

THEREFORE BE IT RESOLVED THAT:

The State Water Board:

1. Approves the amendment to the Basin Plan adopted under Central Coast Water Board Resolution No. R3-2009-0023.

2. Authorizes the Executive Director or designee to submit the amendment adopted under Central Coast Water Board Resolution No. R3-2009-0023, as approved, and the administrative record for this action to the OAL and the TMDLs and shellfish harvesting de-designation to the U.S. Environmental Protection Agency for approval.

CERTIFICATION

The undersigned, Clerk to the Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on February 15, 2011.

_____
Jeanine Townsend
Clerk to the Board

> plastic piping is much less likely to leak under normal bedding conditions. These pipes can be installed easily in narrow trenches or by directional drilling that results in minimal disturbance to property and roads" (p. 769).

In a 1998 textbook entitled *Small and Decentralized Wastewater Management Systems* by Drs. Tchobanoglous and Crites, point out that gravity sewers can also limit conservation measures:

> "In some areas the use of gravity sewers is becoming counter productive because the use of water conservation devices continues to increase. The minimum flows required for gravity-flow sewers to operate make them problematic where development occurs slowly in a large development or where water conservation reduces the wastewater flows significantly. In many cases, the water used to flush conventional gravity-flow collection systems for the removal of accumulated solids far exceeds the water saved through water conservation measures" (p. 8)

Dr. Tchobanoglous was a member of both National Water Research Institute (NRWI) peer reviews of proposed projects for Los Osos, the first the Ripley STEP/STEG plan in 2006 and the second a review of the current LOWWP recommended alternatives. The panel endorsed use of a STEP/STEG collection system (in the first and second reports) and a gravity collection system (in the second report). In the second, it also supported the principles stated in the *Key Environmental Issues Statement* (KEIS) on collections systems presented by a number of local not-for-profit groups. , which recommended STEP/STEG as the environmentally preferred system for Los Osos. Two principles of the KEIS supported by the NWRI were "1) Provide the greatest possible protection against overflows and other releases of partially treated or untreated wastewater from the system, which could pollute Morro Bay Estuary and other sensitive coastal ecosystems (e.g. Sweet Springs Nature Preserve), and 2) Provide the greatest possible protections to the groundwater of the Los Osos water basin." Although the panel did not state its position directly on the I/I and exfiltration issues discussed here—given its endorsement of the KEIS principles, the well-established fact gravity systems have greater I/I, and the statements of Dr. Tchobanoglous to Keith Wimer, which leads to increased chances of overflows—it is reasonable to conclude the NWRI panel endorsed a gravity system for Los Osos if the system was sealed, in particular in high groundwater areas and along the bay (e.g., to avoid seawater contamination in the future). The panel may not have realized that the low pressure component of the hybrid system (5 %) is intended only to pump water uphill when homes are located below the level of mainlines, as indicated in the Fine Screening and project design-build Request for Qualifications (RFQ). The panel may have also have assumed a gravity system would have the special, on-going maintenance program in place to minimize I/I and exfiltration (i.e., the program mentioned in the Fine Screening Report to detect and repair leaks at an added expense compared sealed small-pipe systems). This is a reasonable understanding of the NWRI panel's intent when it endorsed the KEIS principles. <u>If necessary, the EIR process should clarify the panel's intent when it approved the hybrid gravity system, obtaining its input on the need for sealing the system, maintenance, relative feasibility, and other aspects of the gravity system (e.g., its potential construction impacts on roads and infrastructure, especially in sandy soils and high groundwater), including a written response from the NWRI panel in the final EIR.</u> (Note: When a local not-for-profit group offered to pay for the NWRI panel to return to clarify its statements, County staff rejected the proposal). P41-18 CONT

A summary of the potential negative impacts of a gravity-hybrid system compared to the STEP/STEG system (or another small pipe sealed system) include:

YEAR 2000 BEACH CLOSURE AND POSTING INFORMATION

The information presented in this report is derived from SWRCB's Beach Closure/Posted Warning Database which identifies the beach name and the extent of closures and posted warnings in miles (or yards). This database makes it possible to report beach postings and closures by BMDs. Detailed county reports on individual posted warnings, beach closures, and rain advisories for year 2000 are included in the Appendix of this report in geographical order of counties starting from the north of the State to the south. At the end of each individual county report, the total sum of the incidences of posted warnings/beach closures/rain advisories, days (duration), and BMDs are specified. Each time a portion of a beach was posted or closed, the event was counted as a day. The number of days of posted warnings or closures are mentioned to indicate the magnitude of the posting/closure events.

Beach Warning Postings

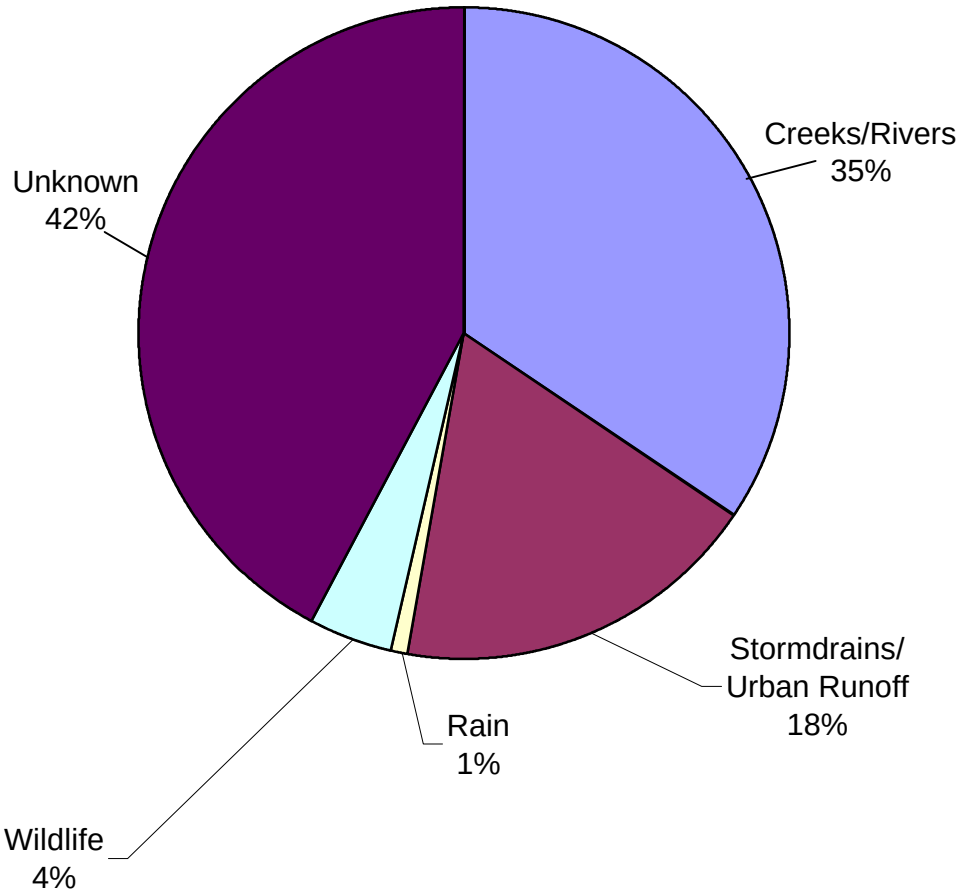
Table 3 presents the data on beach warnings posted during year 2000 from the City of Long Beach and 11 counties, ten of which (Sonoma, San Mateo, Santa Cruz, Monterey, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego) meet the reporting AB 411 requirement criteria as mentioned previously. San Francisco County also reported these data although the County is not required to do so pursuant to AB 411. The coastal counties of Del Norte, Humboldt, Marin, Contra Costa, and Alameda did not have a monitoring program since these counties do not have beaches that meet the AB 411 criteria. Mendocino County on the other hand reported no posting of beach warnings during year 2000. On a statewide basis, 1,285 beach warnings were posted lasting for a total of 8,133 days. This resulted in approximately 1,100 BMDs of posting. Los Angeles County had the maximum number of incidences (325), and San Diego County had the maximum number of days of postings (2,450). Orange County had the maximum number of BMDs posted (about 596). These three counties along with the County of Santa Barbara and the City of Long Beach accounted for over 85 percent of the posting data. The primary cause of the bacterial contamination leading to postings was either unknown or rainfall resulting in storm events.

Figure 2 shows that statewide the source of 35 percent of all BMDs with warnings posted was contamination carried to the beach through creeks/rivers, and 18 percent was through storm drains and urban runoff. The source was unknown for 42 percent of the BMDs with posted warnings.

Six counties (San Mateo, Santa Cruz, Ventura, Los Angeles, Orange, and San Diego) reported permanent beach postings at certain beaches (Table 4). The majority of these permanent postings are due to storm drains or creeks/rivermouths that enter the ocean. Some counties do not opt for permanent postings at beaches near storm drains if the drains are seasonal. Since there is no uniform reporting system of permanent beach postings among the counties, these data are not included in the beach posting data. SWRCB staff is working with county health staff to improve the reporting system for this category. This is the first time the permanent beach postings are presented in the Beach Closure Report.

As a precautionary measure, people should never swim or surf within 100 yards of any posted storm drain or creek/rivermouth.

Figure 2. Sources of Contamination Resulting in Warnings Posted--2000
(Based on Beach Mile-Days)



Wastewater Collection and Treatment Facility Spill Summary

General Information						Notice/Reporting			Nature of Spill					Follow up				
															If No	If Yes		
County	Spill Date	Agency	Facility	RB Office	Sr.	Notify RB in 24 hrs?	Notify OES?[1]	Submit Written Spill Report?[2]	Waste Type	Total Volume Spilled (gallons)	Duration of Spill (hours)	Discharged to	Reason for Spill	Follow up?	Rationale	Description	Rationale	Timeline
Alpine	1/1/06	Bear Valley Water District		S	MRL	Yes	Yes	Yes	Raw sewage	200,000	~24	Bloods Creek						
Amador	12/31/05	Jackson, City of	Collection system	S	RPM	Yes	Yes	Yes	Raw sewage	?	?	Jackson Creek		No	Cannot trace/confirm			
El Dorado	1/3/06	El Dorado Irrigation District	Deer Creek collection system	S	RPM	Yes	Yes	Yes	Raw sewage	4,200	2.5	Deer Creek	Excessive rain uncovered a manhole	Yes		13267 to determine storm return frequency	Need more information to determine appropriate response	
El Dorado	12/31/05	El Dorado Irrigation District	El Dorado Hills WWTP	S	RPM	Yes	Yes	Yes	Groundwater, filter backwash, rainwater, possibly some secondary effluent	5.3 million	17	Carson Creek	Pond overflowed	Yes		13267 to determine storm return frequency and protection of pond from flooding	Was this or was this not a 100-year storm event? Was appropriate flood protection provided?	
El Dorado	1/1/06	El Dorado Irrigation District	Deer Creek collection system	S	RPM	Yes	Yes	Yes	Raw sewage	10,800		Deer Creek	Log knocked off a manhole causing a release	No	Probably outside discharger's control			
El Dorado	12/31/05	El Dorado Irrigation District	Collection system	S	RPM	Yes	Yes	Yes	Raw sewage			Deer, Webber and New York Creeks	Storm caused lift stations to spill	Yes		13267 to determine storm return frequency and design capacity of system	Was this or was this not a 100-year storm event?	
El Dorado	12/31/05	Placerville, City of	Hangtown Creek WWTP	S	RPM	Yes	Yes		Tertiary plus secondary			Hangtown Creek	Heavy rains in previous 24 hrs	Yes		13267 to determine storm return frequency	Was this or was this not a 100-year storm event?	
El Dorado	12/31/05	Placerville, City of	Hangtown Creek WWTP	S	RPM	Yes	Yes		Raw sewage/ primary		12	Hangtown Creek	Heavy rains in previous 24 hrs	Yes		13267 to determine storm return frequency	Was this or was this not a 100-year storm event?	

This spreadsheet contains draft summary information based upon current existing information and assessment, and is subject to change upon receipt of additional information.

Wastewater Collection and Treatment Facility Spill Summary

General Information						Notice/Reporting			Nature of Spill					Follow up				
															If No	If Yes		
County	Spill Date	Agency	Facility	RB Office	Sr.	Notify RB in 24 hrs?	Notify OES?[1]	Submit Written Spill Report?[2]	Waste Type	Total Volume Spilled (gallons)	Duration of Spill (hours)	Discharged to	Reason for Spill	**Follow up?**	Rationale	Description	Rationale	Timeline
Fresno	1/3/06	Southern CA Edison	Big Creek Powerhouse No. 1 WWTF	F	WDH	Yes	Yes	Yes	Secondary, undisinfected wastewater	5,400	10	Big Creek	Rainfall overwhelmed collection system	No	SCE has an emergency plan to haul excess wastewater offsite and responded appropriately. Plan implementation was overwhelmed by record rainfall (9.5 + in.), overturned truck, and landslide.			
Kern	1/1/06	City of Tehachapi	City of Tehachapi WWTF	F	DKP	Yes	NA	Yes	Raw sewage	0		Contained	Surge in flow caused bypass of primary clarifier. No wastewater was actually spilled.	No	All wastewater was contained			
Lake	12/31/05	City of Lakeport	Municipal Sewer Dist. No. 1	S	MRL	Yes	Yes	TBD	Raw sewage	500		Culvert leading to Clear Lake						
Lake	12/31/05	Clearlake Oaks County Water and Sanitation Dist.		S	MRL	Yes	Yes	TBD	Raw sewage	100		Clear Lake						
Lake	12/31/05	Lake County Sanitation District	Southeast WWTF	S	MRL	Yes	Yes	Yes	Raw sewage	5,500		Channel leading to Clear Lake						
Lake	12/31/05	Lake County Sanitation District	Southeast WWTF	S	MRL	Yes	Yes	Yes	Raw sewage	9,000		Streets to storm drains leading to Clear Lake						

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This spreadsheet contains draft summary information based upon current existing information and assessment, and is subject to change upon receipt of additional information.

Wastewater Collection and Treatment Facility Spill Summary

General Information						Notice/Reporting			Nature of Spill					Follow up				
															If No	If Yes		
County	Spill Date	Agency	Facility	RB Office	Sr.	Notify RB in 24 hrs?	Notify OES?[1]	Submit Written Spill Report?[2]	Waste Type	Total Volume Spilled (gallons)	Duration of Spill (hours)	Discharged to	Reason for Spill	**Follow up?**	Rationale	Description	Rationale	Timeline
Lake	12/31/05	Lake County Sanitation District	Northwest WWTF	S	MRL	Yes	Yes	Yes	Raw sewage	5,500		Clear Lake						
Lake	1/1/06	Lake County	Eastlake Landfill	S	SER	No	No	Yes	Leachate	UNK	~ 3 days	Molesworth Creek	Seepage through cover	Yes		Evaluating measures discharger has undertaken		
Nevada	1/1/06	Donner Summit PUD	WWTP	S	RPM	No	No		Filtered and unfiltered wastewater	UNK	18	South Yuba River	Heavy rains in previous 24 hrs	Yes		13267 to determine storm return frequency	Was this or was this not a 100-year storm event?	
Nevada	12/31/05	Grass Valley, City of	WWTP	S	RPM	Yes	Yes	Yes	Raw sewage	1 million		Wolf Creek	Primary clarifiers were overwhelmed by flows and overflowed.	Yes		13267 to determine storm return frequency	Was this or was this not a 100-year storm event?	
Nevada	12/27/05	Nevada County SD	Cascade Shores WWTP	S	RPM	No	No	Yes	Filtered and unfiltered secondary	48,000		Gas Canyon Creek	Filter capacity insufficient for flows received; heavy rains; I/I	Yes		13267 to determine storm return frequency	Was this or was this not a 100-year storm event?	
Nevada	12/28/05	Nevada County SD	Cascade Shores WWTP	S	RPM	No	No	Yes	Filtered and unfiltered secondary	48,000		Gas Canyon Creek	Filter capacity insufficient for flows received; heavy rains; I/I	Yes		13267 to determine storm return frequency	Was this or was this not a 100-year storm event?	
Nevada	12/29/05	Nevada County SD	Cascade Shores WWTP	S	RPM	No	No	Yes	Filtered and unfiltered secondary	59,000		Gas Canyon Creek	Filter capacity insufficient for flows received; heavy rains; I/I	Yes		13267 to determine storm return frequency.	Was this or was this not a 100-year storm event?	
Nevada	12/30/05	Nevada County SD	Cascade Shores WWTP	S	RPM	No	No	Yes	Filtered and unfiltered secondary	59,000		Gas Canyon Creek	Filter capacity insufficient for flows received; heavy rains; I/I	Yes		13267 to determine storm return frequency	Was this or was this not a 100-year storm event?	
Nevada	12/31/05	Nevada County SD	Cascade Shores WWTP	S	RPM	No	No	Yes	Filtered and unfiltered secondary	44,000		Gas Canyon Creek	Filter capacity insufficient for flows received; heavy rains; I/I	Yes		13267 to determine storm return frequency	Was this or was this not a 100-year storm event?	

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Wastewater Collection and Treatment Facility Spill Summary

General Information						Notice/Reporting			Nature of Spill					Follow up				
															If No	If Yes		
County	Spill Date	Agency	Facility	RB Office	Sr.	Notify RB in 24 hrs?	Notify OES?[1]	Submit Written Spill Report?[2]	Waste Type	Total Volume Spilled (gallons)	Duration of Spill (hours)	Discharged to	Reason for Spill	**Follow up?**	Rationale	Description	Rationale	Timeline
Nevada	12/31/05	Nevada County SD	Lake Wildwood WWTP	S	RPM	Yes	Yes	Yes	Secondary, disinfected	120,000	4	Deer Creek	Heavy rains in previous 24 hrs	Yes		13267 to determine storm return frequency	Was this or was this not a 100-year storm event?	
Nevada		Nevada County SD	Lake Wildwood Collection System	S	RPM	Yes	Yes	Yes	Raw sewage	3,000		Little Deer Creek	Grease and debris blocked a sewer main in storm	Yes		13267 to determine storm return frequency	Was this or was this not a 100-year storm event?	
Placer		Placer County	Sewer Maintenance Dist. No. 3	S	RPM	Yes	Yes	Yes	Sludge, unfiltered secondary	UNK	12.5	Miner's Ravine	Heavy rains in previous 24 hrs	Yes		13267 to determine flood protection provided, and to determine storm return frequency and flood stage	Permit requires facilities to be designed, constructed, operated, and maintained to prevent inundation or washout due to floods with a 100-year return frequency.	
Placer	12/31/05	Placer County	Sewer Maintenance Dist. No. 1	S	RPM	Yes	Yes	Yes	Primary (filtered and unfiltered) and secondary (filtered and unfiltered)	13,500	1.5	Rock Creek	Heavy rains in previous 24 hrs	Yes		13267 to determine storm return frequency	Was this or was this not a 100-year storm event?	
Placer	12/31/05	Auburn, City of	WWTP	S	RPM	Yes	Yes	Yes	Tertiary plus filtered, disinfected primary	14.93 million	140	Auburn Ravine		Yes		13267 to determine storm return frequency	Was this or was this not a 100-year storm event?	
Placer	12/31/05	Auburn, City of	collection system; manhole near WWTP entrance	S	RPM	Yes	Yes	Yes	Raw sewage	68,400	9.5	Auburn Ravine		Yes		Discharger plans to isolate manhole to determine if blockage exists		
Placer	12/31/05	Auburn, City of	collection system; 588 High Street	S	RPM	Yes	Yes	Yes	Raw sewage	2,400	2	Storm drain to Auburn Ravine?	Blockage in line removed; spill cleanup infeasible due to 'deluge'	No				

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Wastewater Collection and Treatment Facility Spill Summary

General Information						Notice/Reporting			Nature of Spill					Follow up				
															If No	If Yes		
County	Spill Date	Agency	Facility	RB Office	Sr.	Notify RB in 24 hrs?	Notify OES?[1]	Submit Written Spill Report?[2]	Waste Type	Total Volume Spilled (gallons)	Duration of Spill (hours)	Discharged to	Reason for Spill	Follow up?	Rationale	Description	Rationale	Timeline
Placer	12/31/05	City of Roseville		S	RPM	Yes	Yes	Yes	Raw sewage	3.8 million	10	Dry Creek	Surcharging of collection system due to flooding	Yes		13267 to determine flood protection provided, and to determine storm return frequency and flood stage	Permit requires facilities to be designed, constructed, operated, and maintained to prevent inundation or washout due to floods with a 100-year return frequency	
Placer	1/4/06	City of Roseville		S	RPM	No	Yes		Raw sewage	UNK	>48	Dry Creek	Discovered after flood waters receeded	Yes		13267 to determine storm return frequency	Was this or was this not a 100-year storm event?	
Placer	12/31/05	Placer County	Applegate WWTF	S	MRL				Raw sewage	1,000		Spill was contained						
Sacramento	12/31/05	City of Folsom	Manhole	S	PHL	Yes	Yes	Yes	Raw sewage	1,000		Spill was contained	Manhole overflow	No	Small spill			
Sacramento	12/31/05	City of Galt	Manhole	S	PHL	Yes	Yes	No	Raw sewage	<1,000			Manhole overflow	No	Small spill			
Sacramento	12/31/05-1/2/06	Sacramento County CSD-1	Walnut Grove	S	PHL	Yes	Yes	Yes	Raw sewage	250,000	48+	Unnamed	Manhole overflow	Yes		Inspected		
Sacramento	12/31/05	Sacramento County CSD-1	Manger Way	S	PHL	Yes	Yes	Yes	Raw sewage	>1,000	>7	Storm drain	Manhole overflow	Yes		Inspected 1/5/06		
Sacramento	12/31/05	Sacramento County CSD-1	Linda Creek Ct	S	PHL	Yes	Yes	Yes	Raw sewage	>1,000	>6	Drainage ditch	Manhole overflow	Yes		Inspected 1/5/06		
Sacramento	12/31/05	Sacramento County CSD-1	Fruitridge Rd	S	PHL	Yes	Yes	Yes	Raw sewage	560,000	>12	Drainage ditch, street, property	Manhole overflow	Yes		Inspected 1/5/06		
Sacramento	12/31/05	Sacramento Regional County Sanitation Dist.	Mira del Rio Station N-16	S	PHL	Yes	Yes	Yes	Raw sewage	15 million		Street, homes, American River	Manhole overflow	Yes		Inspected 1/5/06		
Sacramento	12/31/05-1/3/06	Sacramento Regional County Sanitation Dist.	SRCSD WWTF	S	PHL	Yes	Yes	Yes	Chlorinated secondary effluent	1 million		Laguna Creek	Line breakage	Yes		Inspected 1/5/06		

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Wastewater Collection and Treatment Facility Spill Summary

General Information						Notice/Reporting			Nature of Spill					Follow up				
															If No	If Yes		
County	Spill Date	Agency	Facility	RB Office	Sr.	Notify RB in 24 hrs?	Notify OES?[1]	Submit Written Spill Report?[2]	Waste Type	Total Volume Spilled (gallons)	Duration of Spill (hours)	Discharged to	Reason for Spill	Follow up?	Rationale	Description	Rationale	Timeline
Sacramento	12/31/05	Sacramento Regional County Sanitation Dist.	Elk Grove/Florin Road	S	PHL	Yes	Yes	Yes	Raw sewage	650,000		Drainage channel	Manhole overflow	Yes		Inspected 1/5/06		
Sacramento	12/31/05	Sacramento Regional County Sanitation Dist.	Kilgore/ Sunrise Site	S	PHL	Yes	Yes	Yes	Raw sewage	700,000		Contained on construction site	Failed plugs	Yes		Inspected 1/6/06		
Sacramento	12/31/05	Sacramento Regional County Sanitation Dist.	Bradshaw 6B Project	S	PHL	Yes	Yes	Yes	Raw sewage	<10,000		Contained on construction site	Failed plugs	Yes		Inspected 1/6/06		
Sacramento	12/31/05	City of Sacramento		S	PHL	Yes	Yes		Combined wastewater	46,000		Street	Excess storm flow	No				
Sacramento	12/31/05	City of Sacramento		S	PHL	Yes	Yes		Combined wastewater	1,500		Street	Excess storm flow	No				
San Joaquin		City of Ripon	Industrial sewer disposal fields	S	MRL	Yes		Yes				Industrial disposal field inundated due to rising river levels on the Stanislaus River						
Shasta	1/3/2006	City of Redding	Clear Creek WWTP	R	BJS	Yes		Yes	Partially treated and diluted wastewater	20 million per day at worst	3-5 days	Sacramento River and small tributary creeks	Excess I/I due to storm intensity and duration. May be other Discharger contributing factors	Yes		Inspected WWTP and collection system overflow sites; waiting on WQ samples of effluent and receiving water; requested data on contributing factors	Other local WWTPs did not have same degree of problem	
Sierra	12/31/05	City of Loyalton		S	MRL	Yes	Yes	TBD	Raw sewage/ rain water mix	4000		Smithneck Creek						

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Wastewater Collection and Treatment Facility Spill Summary

General Information						Notice/Reporting			Nature of Spill					Follow up				
															If No	If Yes		
County	Spill Date	Agency	Facility	RB Office	Sr.	Notify RB in 24 hrs?	Notify OES?[1]	Submit Written Spill Report?[2]	Waste Type	Total Volume Spilled (gallons)	Duration of Spill (hours)	Discharged to	Reason for Spill	**Follow up?**	Rationale	Description	Rationale	Timeline
Sierra	12/31/05	City of Loyalton		S	MRL	Yes	Yes	TBD	Secondary treated wastewater mixed with stormwater/ groundwater	4 million		Smithneck Creek						
Sutter		Yuba City, City of	WWTF	S	RPM	Yes	NA	NA	Reportedly empty disposal ponds were overtopped by Feather River	NA		Feather River	Inundation of disposal ponds inside levee	No	Addressed through permitting process - permit requires closure of ponds within floodplain			
Yuba	1/3/06	City of Wheatland	WWTF	S	MRL	No	Yes		Wastewater mixed with river water	270,000	15	Bear River	Bear River toppled levee and spilled onto infiltration beds					
Yuba		Linda County Water District	WWTF	S	RPM	No	No	No	Secondary treated wastewater	UNK		Feather River	River level rose and inundanted ponds	No	Addressed through permitting process - proposed permit renewal requires closure of ponds within floodplain			
Yuba	12/31/05	City of Marysville		S	MRL	Yes	Yes	Yes	Wastewater mixed with river water			Feather River						

[1] The "reportable quantity" for notification of OES is 1000 gallons (CWC section 13271 and 23 CCR section 2250). This field is not applicable for spills of less than 1000 gallons.

[2] Spill report due in 5 days for NPDES Program; spill report due in 14 days for WDR Program.

NA = Not applicable TBD = To be determined UNK = Unknown at this time

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This spreadsheet contains draft summary information based upon current existing information and assessment, and is subject to change upon receipt of additional information.

Chapter 1
Introduction

1.1 Background

Many municipalities throughout the United States have sewerage systems (separate and combined) that may experience exfiltration of untreated wastewater from both sanitary and combined sewers. Sanitary sewer systems are designed to collect and transport to wastewater treatment facilities the municipal and industrial wastewaters from residences, commercial buildings, industrial plants, and institutions, together with minor or insignificant quantities of ground water, storm water, and surface waters that inadvertently enter the system. Over the years, many of these systems have experienced major infrastructure deterioration due to inadequate preventive maintenance programs and insufficient planned system rehabilitation and replacement programs. These conditions have resulted in deteriorated pipes, manholes, and pump stations that allow sewage to exit the systems (exfiltration) and contaminate adjacent ground and surface waters, and/or enter storm sewers. Exfiltration is different from sanitary sewer overflows (SSOs). SSOs are overflows from sanitary sewer systems usually caused by infiltration and inflow (I/I) leading to surcharged pipe conditions. SSOs can be in the form of direct overflows to receiving water, street flooding, and basement flooding; whereas exfiltration is not necessarily caused by excess I/I and is merely caused by a leaking sewer from its inside to its surrounding outside.

Untreated sewage from exfiltration often contains high levels of suspended solids, pathogenic microorganisms, toxic pollutants, floatables, nutrients, oxygen-demanding organic compounds, oil and grease, and other pollutants. Exfiltration can result in discharges of pathogens into residential areas; cause exceedances of water quality standards (WQS) and/or pose risks to the health of the people living adjacent to the impacted streams, lakes, ground water, sanitary sewers, and storm sewers; threaten aquatic life and its habitat; and impair the use and enjoyment of the Nation's waterways.

1.2 Objectives

Although it is suspected that significant exfiltration of sewage from wastewater collection systems occurs nationally, there is little published evidence of the problem and no known attempts to quantify or evaluate it on a national basis. Accordingly, the objectives of this

Table 1: Electricity Usage

	Collection (kWhr/year)	Treatment Process and Wastewater Flows (kWhr/year)
Project 1[a]	425,000	1.07 million
Project 2[a]	500,000	1.36 million
Project 3[a]	500,000	1.36 million
Project 4[a]	500,000	1.24 million
Preferred Project[b]	500,000	1.36 million

[a] Data obtained from Table 3-7 in the Draft EIR.
[b] The electrical usage is estimated based on data from Appendix K-2.

Appendix K-2 includes vehicle miles traveled for construction and operational activities. Based on a general assumption of 12 miles per gallon for on-street vehicles, fuel estimates are derived for construction and long-term operations. A summary of the fuel consumption for Proposed Projects 1 through 4 as well as the Preferred Project is shown in Table 2 below.

Table 2: Fuel Usage[a]

	Construction (total gallons)	Operation (gallons/day)
Existing	NA	22
Project 1	473,715	62
Project 2	431,958	59
Project 3	399,028	59
Project 4	428,880	51
Preferred Project	423,444	59

[a] Data derived from Appendix K-2 and a general assumption of construction and operational on-street vehicles traveling at 12 miles per gallon.

To reduce energy consumption, Mitigation Measures 5.9-C1(e) and 5.9-C1(h) have been provided. Mitigation Measure 5.9-C1(e) encourages the use of heavy duty off road vehicles modeled after year 1996, as feasible. Mitigation Measure 5.9-C1(h) encourages the use of Compressed Natural Gas (CNG), liquefied natural gas (LNG), biodiesel, or propane for on-site mobile equipment instead of diesel- powered equipment. In addition to reducing short-term construction energy use, long-term energy conservation design measures are included in the project. The collection system is designed as a hybrid in order to incorporate low pressure pipelines and gravity. Additionally, the treatment plant headworks have also been moved to the north side of the Tonini site to allow for the flow of gravity throughout the treatment plant to reduce the need for additional pumps from one treatment process to another.

Appendix E-1 Expanded Drainage and Surface Water Quality Analysis Page 5.3-91

The significance determination regarding project-specific level of significance after mitigation for Proposed Projects 1 through 4 of Appendix E-1, Expanded Drainage and Surface Water Quality Analysis, is revised as follows:

Project-Specific
Proposed Projects 1 through 4
~~Less than Significant~~ No Impact.

Appendix F-1 Expanded Geology Analysis Page 5.4-17

The mitigation measures identified for Proposed Projects 1 through 4 under cumulative of Appendix F-1, Expanded Geology Analysis, is revised as follows:

Cumulative
Proposed Projects 1 through 4
~~Implementation of Mitigation Measures 5.4-B1 is required~~ No mitigation measures are required.

Appendix F-1 Expanded Geology Analysis Page 5.4-18

The significance determination regarding cumulative level of significance after mitigation for Proposed Projects 1 through 4 of Appendix F-1, Expanded Geology Analysis, is revised as follows:

Cumulative
Proposed Projects 1 through 4
~~Less than Significant~~ No Impact.

Appendix F-1 Expanded Geology Analysis Page 5.4-29

Mitigation Measure 53.4-G1is revised as follows:

5.4-G1 Prior to approval of improvement and building plans for the proposed collection system facilities, ~~and~~ facilities at the treatment plant site, and facilities at Broderson, a design-level geotechnical report shall be prepared that addresses and reduces potential expansive soil impacts to less than significant. The expansive soil data shall be used with the requirements of the California Building Code (2007), as adopted by the County of San Luis Obispo.

Table 5.9-14: Construction GHG Emissions

System/Source	Metric Tons CO_2e per year			
	Project 1	Project 2	Project 3	Project 4
Collection/Conveyance				
On road vehicular	1,422	1,116	1,116	1,142
Off road equipment	440	414	414	424
Construction materials off-site	804	1,243	1,243	960
Collection/Conveyance Total	2,666	2,773	2,773	2,526
Treatment				
On road vehicular	245	205	246	245
Off road equipment	519	446	489	519
Construction materials off-site	2,115	3,043	3,043	3,095
Treatment Total	2,879	3,693	3,778	3,859
Disposal				
On road vehicular	491	670	491	491
Off road equipment	838	924	838	838
Disposal Total	**1,328**	**1,594**	**1,328**	**1,329**
GRAND TOTAL	**6,874**	**8,060**	**7,879**	**7,713**
Source: MBA 2008.				

Appendix K-1 Expanded Air Quality Analysis Page 5.9-65

Based on a review of the Greenhouse Gas (GHG) analysis contained in Section 5.9 of the Draft EIR and Appendix K-1, Expanded Air Quality Analysis, there was an error in the calculation related to on-road vehicular GHG emissions. Table 5.9-15 of Appendix K-1, Expanded Air Quality Analysis, is revised as follows:

~~Table 5.9-15: Operational GHG Emissions~~

~~System/Source~~	~~Metric Tons CO2e per year~~			
	~~Project 1~~	~~Project 2~~	~~Project 3~~	~~Project 4~~
~~Collection~~				
~~On road vehicular~~	~~98,564~~	~~69,668~~	~~69,668~~	~~69,668~~
~~Energy usage~~	~~169~~	~~199~~	~~199~~	~~199~~
~~Septic tanks~~	~~624~~	~~0~~	~~0~~	~~0~~
~~Collection Total~~	~~99,357~~	~~69,867~~	~~69,867~~	~~69,867~~

Table 5.9-15 (Cont.): Operational GHG Emissions

System/Source	Metric Tons CO2e per year			
	Project 1	Project 2	Project 3	Project 4
Disposal Total	0	0	0	0
GRAND TOTAL	1,660	839	839	1,109
Current Operations	941	941	941	941
NET DIFFERENCE	720	-102	-102	169
Percent Reduction	43.4%	-12.1%	-12.1%	15.2%
Source: MBA 2008.				

Appendix K-1 Expanded Air Quality Analysis Page 5.9-75

The discussion regarding cumulative impact analysis for Proposed Projects 1 through 4 of Appendix K-1, Expanded Air Quality Analysis, is revised as follows:

Cumulative Impact Analysis

Related projects within the greater cumulative project area are detailed in Section 4.2 and Exhibit 4.2-1 in the Draft EIR. Three of the nine related projects (Los Osos CSD Waterline Replacement, Los Osos Valley Road Palisades Storm Drain, and AT&T Cable) physically overlap with the study area for the proposed project but are either completed or expected to be completed by the time construction of the proposed project is anticipated to begin (2010). Six of the nine related projects (State Park Marina Renovation, Morro Bay Wastewater Treatment Plant, Dredging of Morro Bay, CMC Wastewater Treatment Plant, Phase II Steam Generator Replacement at Diablo, and Spent Fuel Storage Facility at Diablo) have no physical overlap with the proposed project; however, they could contribute to GHG impacts. Since Proposed Projects 1 through 4 ~~could reduce GHG emissions compared to the existing wastewater system, implementation of any of the proposed projects would not contribute to an adverse cumulative impact related to GHG emissions~~ would increase GHG emissions during construction activities and could reduce long-term GHG emissions compared to the existing wastewater system. Proposed Projects 1 through 4's contribution to GHG emissions is considered less than cumulatively considerable, and thus result in a less than significant impact.

Appendix L-1 Expanded Noise Analysis Page 5.10-62

The discussion regarding cumulative impact analysis for Proposed Projects 2 of Appendix L-1, Expanded Noise Analysis, of the Draft EIR is revised as follows:

Capital, operating, maintenance, and replacement costs of the project were developed in the Fine Screening Report over its estimated useful life, which is often referred to as "life-cycle" costs. Generally, a 30-year period was used, which matches the expected life span of many major project components. (Although most major components of the systems may last longer than thirty years, their capital costs will have been fully paid in that time frame or shorter.) Where major components are not expected to last 30 years (such as liners in treatment and storage ponds), the component replacement costs over a 30-year period were included. This method also allows costs to include annual operations and maintenance, plus appropriate replacement costs for the various alternatives.

From a CEQA perspective, it is important that the EIR address the reasonably foreseeable impacts of the proposed project. Given that the majority of the prohibition zone is already subdivided, and that the area lies fully within the Urban Reserve Line, it is reasonable to expect that the area will build out within the lifespan of the LOWWP (50 to 100 years). Therefore, the Draft EIR evaluates the impacts resulting from constructing a project based on the buildout of the service area to the extent those impacts can be reasonably predicted.

TOPICAL RESPONSE 3: WATER RESOURCES AND THE PROJECT SCOPE

Several commentors focused on how the County is approaching water reclamation, beneficial reuse of treated effluent, and sustainability of the groundwater supplies. Several state that agricultural exchange must be a central component of the LOWWP. Several commentors also point to language in AB 2701 identifying that the County has some legislative ability to implement water resource efforts as part of the wastewater project. Several commentors assert that the Draft EIR is deficient in this respect.

These comments seek to expand the LOWWP beyond solving the wastewater issue and do not recognize the cooperative efforts between the water purveyors and the County under the Court approved Interlocutory Stipulated Judgment; which is guiding resolution of the existing groundwater litigation. Seawater intrusion is occurring and must be resolved. The LOWWP will reduce the existing rate of seawater intrusion. Nevertheless, expanding the wastewater project to incorporate other programs will repeat the LOWWP history of trying to do too much and then risking not funding and constructing the project as a result of further delays. RWQCB sanctions could also occur. Developing a wastewater project is the single most important issue to addressing the greater water resource problem, and solving the water resource issue requires completing a wastewater project.

The County's wastewater project approach is to develop a project that provides the County, the water purveyors and the community with the ability to solve the water resource issue. An approach that attempts to solve all problems with one project could delay LOWWP construction under the premise that all problems must be solved simultaneously or nothing should be done. Over the past two years, following the guidelines of the Court approved Interlocutory Stipulated Judgment; the County has met with the community, the purveyors, environmental, agricultural, and cultural groups, and each

- Facultative Ponds and Constructed Wetlands
- Partially Mixed Facultative Ponds

Based on the particular Los Osos area requirements, and comparing the various technologies to each other, the list was further narrowed to three treatment alternatives for evaluation in the Draft EIR as discussed Draft EIR Section 7, Alternatives to the Proposed Project. These alternatives, which are all viable systems, also encompass a full range of potential impacts relative to land requirements, energy use, and performance. The three technologies are:

- Biolac™
- Oxidation Ditch
- Facultative Ponds

The project selection process through the Design/Build Request for Qualifications is specifically designed to invite alternative technology proposals. Should an alternative technology come forward that meets all current criteria as well as the three technologies do, and reduces costs or environmental impacts, that technology will be considered as well.

TOPICAL RESPONSE 7: ALTERNATIVE DISPOSAL OPTIONS

The effluent disposal alternatives in the Draft EIR all utilize the same set of disposal options: a sprayfield at the Tonini site and subsurface disposal at Broderson. These options were selected because they best meet the LOWWP's objectives. These options:

- Comply with RWQCB Waste Discharge Requirements.
- Contribute to alleviating groundwater contamination by placing treated water at Broderson.
- Address water resource issues by mitigating the project's impacts on water supply and saltwater intrusion by placing treated water at Broderson. And, by including space at the treatment plant for further treatment and building a return line back to Broderson, maintain the widest possible options for beneficial reuse of treated effluent.
- Incorporate measures to minimize potential environmental impacts.
- Minimize lifecycle costs and the related affordability impacts to residents.
- Comply with applicable local, state, and federal permits.

Other disposal options include potential leachfield sites within the community, as evidenced by the project the LOCSD proposed in 2001. However, these urban leachfields require the use of multiple street rights of ways to install leach lines, leading to on-going high maintenance costs and concerns about the long-term effects of leachfields in the urban area. Together with Broderson, these sites, could not accommodate the entire expected flows, leaving a substantial volume (over one-third) of the effluent needing disposal. A key project requirement is redundancy, including providing for an alternate disposal area outside of the urban area in the unlikely event that for any reason in-town

disposal is not usable in either the long or short term. Alternate in-town disposal sites would not meet this redundancy goal, in addition to being unable to accommodate all of the flows.

TOPICAL RESPONSE 8: THE BRODERSON LEACHFIELD

Opportunities for realizing beneficial basin results lie in the unique geology and soils in Los Osos, and especially at the Broderson site. These conditions were identified during development of the initial wastewater project proposal for Los Osos in 1985. Ancient dune sands overlie the Paso Robles formation and create an effective water cleansing and storage condition. Water discharged to the perched and shallow aquifers in the central and northern portion of Los Osos is quickly lost to the Bay and to inaccessible portions of the subsurface aquifer; however, water discharged to the southern edge of the sand formations, like those at Broderson, that have more favorable conditions to the upper and lower groundwater aquifers and greater distance to the Bay, has an opportunity to spread both downward and laterally through the subsurface formation, allowing for both filtration and unsaturated soil zone treatment (aerobic). A partial key to this effect is the presence of lamellae, which are thin clay layers (finer than a pencil) with a coating of iron oxides both above and below each layer. As water contacts these discontinuous layers, it tends to move laterally until reaching the edge of the lamella, then stair steps downward before reaching the next layer. This effect both slows and spreads the water, allowing more soil contact time with its accompanying filtering and cleansing effects, preventing over-rapid inflow of treated effluent into the deeper water bearing layers below.

An important aspect of disposing of treated water at Broderson is the timing and amount of effluent that will disposed of at the site. “Application rate” describes the amount of water applied as a ratio to the surface area of soils in contact with a leachfield trench. “Hydraulic loading” describes the amount of water applied as a ratio to the overall area of the site. Although various scientific studies addressed the issue, work performed by Fugro Engineers in support of the County’s 1989 project involved the construction of subsurface infiltration drywells, essentially a large cylinder shaped excavation filled with gravels. Water was introduced at varying rates and subsurface monitoring devices were used to track the movement of the water. Because there was (and is) no readily available source of treated wastewater effluent, potable water was used for these tests. The maximum soil infiltration rate was measured at 180 gallons of water per day per square foot of area. However, the rate is adjusted downward because the tests used water with a lower solids component than treated wastewater. The current project, in order avoid impacts not at Broderson but in areas closer to the Bay (see below) will use a maximum hydraulic loading of 3.1 gallons of water per day per square foot of area. This application rate is less than 2 percent of the observed infiltration rate and 12 percent of the maximum design application rate, which allows for operational considerations such as soil column drying and system maintenance.

The potential for treated wastewater to flow into the yards of residences on Highland Drive was investigated in two studies prepared by Cleath and Associates and incorporated by reference into the Draft EIR. The second study, Hydrogeologic Investigation of the Broderson Site Phase 2 Impact

alternatives for water conservation were identified. Three options were selected as being the most cost effective:

1. Community Fixture Replacement - mandating that bathrooms be retrofitted with all low-flow fixtures prior to hookup to the new sewer;
2. Public Education; and
3. High-Efficiency Appliance Promotion Programs.

The Urban Water Management Plan predicted that these three programs would reduce indoor water consumption by 14.5 percent in nine years. To achieve the desired minimum 160 AFY reduction in effluent, the LOWWP will implement these three water conservation measures as described in Section 3.3.2 of the Draft EIR. The most effective is expected to be replacing domestic and commercial bathroom fixtures, including toilets and shower heads, with low flow fixtures. Costs for a toilet replacement program were included in project cost estimates in the Fine Screening Report. The reduction in overall water use in the prohibition zone equates to 160 acre feet less water pumped from the lower aquifer on an annual basis. If the 160 AFY water conservation goal is not met, then the LOWWP would work with the water purveyors to implement additional water conservation measures.

The LOWWP does not prevent the community from achieving higher water use reductions through the development and implementation of more sophisticated, or more restrictive, mandatory conservation measures.

TOPICAL RESPONSE 10: INFILTRATION, INFLOW, AND EXFILTRATION

Infiltration/Inflow (I/I) and exfiltration rates of the various pipe joint alternatives are fully discussed in the Flows and Loads Technical Memorandum (July 2008). According to that document, properly installed bell-and-spigot sewers will be watertight at first, and then may slowly lose some of their integrity as the surrounding soils shift, compressing the pipes, and compromising their seals at the joints. Some studies show that PVC pipe with bell and spigot joint can perform as new, even after decades of use, indicating that infiltration rates may be near zero (Bauer, 1990; Alferink, 1995; Whittle, 2005). However, a treatment plant should be designed to accommodate a reasonably conservative level of I/I. In order to ensure that levels of I/I do not rise to the point that they may exceed the treatment capacity, or cause unwanted impacts a maintenance and rehabilitation program will be instituted.

Communities with excessive I/I often are those with sewer systems dating from an era before modern sewer construction techniques and materials and often included the use of combined sanitary and storm sewers. The key to maintaining the watertight status of bell and spigot type pipe joints is the implementation of an ongoing Sewer System Management Plan, which is now a component of California regulations (see the Preferred Project Evaluation in Appendix Q.1, Introduction, and

3. Eliminate or reduce non-storm water discharges to storm sewer systems and other waters of the nation, and;
4. Perform inspections to verify that all BMPs have been implemented.

The County's standard construction specifications require contractors to retain a copy of the SWPPP and all other permit requirements at the construction site. In addition, contractors are required to promptly notify the County if suspected hazardous materials are encountered during construction, and require that any such materials be disposed of in accordance with the applicable state and federal codes.

Water generated by de-watering activities will be required to comply with the terms and conditions of a permit issued by the Regional Water Quality Control Board (RWQCB). As explained in Draft EIR Section 3, Project Description, Section 3.3.4 Construction Activities, Baker tanks will be moved from one temporary location to another to contain the water pumped during dewatering operations. If construction water requires treatment, that treatment would be tailored to the specific contaminants targeted for removal. If required, portable treatment systems, designed for construction purposes, could be employed on a temporary basis as the project proceeds. Finally, the costs and efforts associated with dewatering and treatment would be compared with the cost and efforts with construction, such as directional drilling, through a value engineering process.

Stormwater flows during LOWWP operations have been estimated for the preliminary design based on a 25 to 100-year design storm as required by the County's Public Improvement Standards. Drainage channels, retention and detention basins have been included in the preliminary design that comply with Low Intensity Development (LID) standards for the various LOWWP facilities and sites as described in Appendix Q.3, Preferred Project Description.

TOPICAL RESPONSE 12: SEWER SYSTEM MANAGEMENT PLAN

The key to maintaining the water tight status of bell and spigot type pipe joints, as described in Topical Response 10, Infiltration, Inflow, and Exfiltration, is implementing an ongoing Sewer System Management Plan (SSMP), which is now a component of California regulations. See http://www.waterboards.ca.gov/water_issues/programs/sso/index.shtml#plan and Appendix Q.3 Preferred Project Description, Section Q.3.3, Project Characteristics.

The LOWWP will develop and implement a SSMP with the overall objective of facilitating proper funding and management of the sewer systems. The SSMP will include provisions to provide proper and efficient management, operation, and maintenance of the sewer system, while taking into consideration risk management and cost benefit analysis. Additionally, the Plan will contain a spill response plan that establishes standard procedures for immediate response to a spill in a manner designed to minimize water quality impacts and potential nuisance conditions.

The SSMP will address the elements described below.

subject to an operations manual that includes an action plan to implement contingency measures in the unlikely event of a spill. Project developments have been sited to avoid steelhead bearing streams and their tributaries with adequate setbacks. Project designs incorporate elements to curtail and contain spills in an unlikely spill event. The commentor is directed to the preferred project description contained within Appendix Q for a detailed description of the design elements. Specific engineering designs for all elements have been prepared for the project's Coastal Development Permit application.

See also Topical Response 10, Infiltration, Inflow, and Exfiltration, addressing infiltration, inflow, and exfiltration, and Topical Response 12, Sewer System Management Plan, addressing the project's Sewer System Management Plan. \

Response to Comment A1-5

This comment requests that a discussion be provided that addresses how the installation of the facility may influence water use or anthropogenic growth and development, in-turn resulting in impacts to steelhead and critical habitat over the long-term. It is anticipated that the proposed project would result in an increase in anthropogenic growth but a decrease in water use within the community of Los Osos. The Los Osos Community Services District Urban Water Conservation Plan would result in a 10 percent per capita water demand reduction. See also Topical Response 9, Water Conservation Measures.

Response to Comment A1-6

This comment seeks clarification on whether the project will affect the amount and extent of surface flow in any steelhead bearing streams. The project would not affect the amount and extent of surface flow in steelhead bearing streams. Project impacts to steelhead bearing streams will be limited to the trimming of a few trees during installation of pipelines at the Los Osos Creek bridge crossing and Warden Creek bridge crossing. No in-stream work will be required and no developments are proposed within steelhead bearing streams. Project operation will not result in a change in runoff values from pre-project conditions. Post-project surface flows are anticipated to be the same as pre-project flows including the treatment plant site with its stormwater storage and storm drain outfall to a tributary of Warden Creek.

Response to Comment A1-7

This comment is seeking confirmation that there will be no direct discharge of wastewater or treated effluent into steelhead bearing streams or water bodies that connect to steelhead bearing streams. The proposed project would not result in any discharge, direct or indirect, of wastewater or treated effluent into steelhead bearing streams or tributary waters to steelhead bearing streams. All wastewater will be contained within the collection and conveyance system pipelines and treatment facility during operation. Some of the treated effluent will be contained within conveyance pipelines that will directly connect to the leachfield element on the Broderson property. The remaining treated effluent will be discharged via sprayfields for evapotranspiration within upland areas on the Tonini property.

It should be acknowledged that the tributaries to Warden Creek on the Tonini property will be enhanced from their current state as a result of the land use conversion resulting from the project. The removal of grazing and agricultural activities within and around the drainages on the Tonini property will result in an increase in water quality and stream function. Under pre-project conditions, these resources are exposed to direct disturbance and degradation from agricultural activities (in-stream equipment use, stream course diversion, disruption of natural hydrology, etc) and cattle use (excessive trampling, direct water contact, fecal deposition, grazing, etc.). These adverse uses under pre-project conditions would no longer occur under post-project conditions. The project's beneficial effects would have immediate and long-term value to downstream waters within Warden Creek and flows discharging into Morro Bay and steelhead-bearing waters.

Response to Comment A1-8

This comment requests that potential risks and impacts that may result from runoff at the facility site, leachfields, and sprayfields into steelhead bearing streams be discussed and identified. The comment further asks how runoff from these sites is to be contained or treated. See Draft EIR Section 5.3, Drainage and Surface Water Quality, and Appendix E, Drainage and Surface Water Quality, for discussion on drainage and surface water quality.

For all project elements, runoff during construction will be maintained through the implementation of project specific stormwater runoff Best Management Practices, in accordance with objectives outlined in the County of San Luis Obispo Storm Water Management Plan. Adherence to the Storm Water Management Plan would ensure that water quality standards and waste discharge requirements are not violated and the project is in compliance with National Pollutant Discharge Elimination System and Central Coast Regional Water Quality Control Board requirements. A Storm Water Pollution Prevention Plan shall also be prepared in accordance with the guidelines and requirements provided by the State Water Resources Control Board. The project would also adhere to the requirements outlined in the project specific Sedimentation and Erosion Control Plan. Compliance with these standard conditions during construction would prevent runoff-related impacts to steelhead bearing streams.

The leachfield and sprayfield elements of the project are not anticipated to result in risks or impacts associated with runoff during operation. The leachfield element does not include the development of any permanent aboveground structures or other developments that would result in an increase in surface runoff. Surface runoff would remain relatively unchanged during the operation of the leachfield due to the shallow excavation depths required and the use of gravel and native soil substrate to promote continued percolation of surface water flows. The sprayfields will not be operated during rain events and therefore would not contribute to excessive runoff. Evapotranspiration during operation would not result in any excessive runoff during the remaining portions of the year.

condition of providing wastewater service. It is also not clear whether or not this will require additional enforcement actions by the RWQCB against individual property owners.

Response to Comment A4-5

This comment expresses a concern regarding the lack of discussion regarding potential salt accumulation. The LOWWP project will not increase salt accumulation in the Los Osos groundwater basin because the present discharge of septic systems has the same concentration of salts that would be present in the LOWWP sewage effluent. The project as mandated will remove nitrogen from the domestic effluent in the prohibition zone and dispose the water at the designed locations (Broderson and Tonini sprayfields). The salt loading evaluation for Broderson and Tonini were evaluated in the Draft EIR in appendix D-2, Hydrogeological Impacts Study. The inherent salt buildup in aquifers beneath lands used for irrigated agriculture was considered in the Draft EIR with respect to existing groundwater conditions. Utilization of LOWWP effluent or native groundwater with a comparable TDS concentration for irrigation will result in essentially the same impact to underlying soils. The salts leached into the bedrock aquifer beneath Tonini will reach an equilibrium concentration as it is an open groundwater system through which flushing occurs. The TDS concentration of treated effluent that would be used for sprayfield disposal at the Tonini site is estimated at approximately 620 mg/l and is comparable to the groundwater that underlies the Tonini site that was measured and averaged 606 mg/l. Because of the similar TDS concentrations, the effects on groundwater from using the LOWWP effluent as an irrigation source versus pumping groundwater for crop irrigation are the same. Based on these conditions the salt loading impacts to groundwater from irrigating crops with effluent at the proposed Tonini sprayfield site are considered less than significant. Also, see Topical Response 7, Alternative Disposal Options, and Topical Response 8, The Broderson Leachfield.

Response to Comment A4-6

This comment expresses a concern with the lack of discussion regarding the design of the leachfield disposal system. The Broderson leachfield design will include all of the parameters listed in this comment. Page 3-42 and 3-43 of the Draft EIR provide some of the details requested. Appendix Q, Preferred Project Evaluation Section Q.3, Preferred Project Description, provides additional details on an operational plan, monitoring wells and a stormwater runoff plan for the leachfields.

Response to Comment A4-7

This comment expresses a concern regarding the lack of discussion regarding the mitigation for disposal design for the Proposed Project. The historical percolation of storm water into the Broderson site is accommodated by the highly permeable soils. Extensive study has been conducted to evaluate the site-specific soil conditions at Broderson (see Topical Response 8, The Broderson Leachfield) which indicate that the proposed disposal rate is substantially lower than the soil capacity as tested. Soil testing at the site has demonstrated an ultimate soil infiltration capacity of 180 gallons per day per square foot. This is many times more capacity than the amount of rainfall that may be produced, even during a severe event. For example, a storm that produced 6 inches of rain in one day equates to

3.7 gallons per day per square foot. The Broderson site is expected to receive a maximum hydraulic loading of 3.1 gallons per day per square foot, or 0.8 MGD, of treated effluent during wet weather. The combined loading during wet weather is many times less than the infiltration capacity of the soil. The leach lines will be buried several feet deep, below any surface water flows. The project is also designed with storage ponds at the treatment facility (46 acre-feet of capacity, or approximately 15 million gallons) to provide the retention time anticipated for balancing disposal rates between spray disposal at Tonini and leachfield disposal at Broderson. For example, during times of inclement weather, effluent can be stored on site at Tonini until spraying or leachfield operations can resume.

Response to Comment A4-8

This comment expresses concern about effluent quality (nitrogen) and questions what method is used for the separate nitrogen removal that is referenced on Draft EIR page 3-57. The referenced comment is made with respect to Proposed Project 4 and the use of facultative pond effluent treatment. As noted in Draft EIR Section 7, Alternatives to the Proposed Project page 7-44, this process requires nitrogen removal and algae management for proper operation within the RWQCB standards for nitrogen. Further, the Carollo Engineers' Fine Screening Report observes that mixed facultative ponds generally do no fully nitrify the effluent and additional measures are needed to accomplish this. The report suggests the use of methanol as a carbon source to meet the nitrogen level requirements of the effluent. This method is employed in the Environmentally Superior Alternative, as identified in Draft EIR Section 7.4 and presented in that section's Table 7-7.

Response to Comment A4-9

This comment expresses a concern regarding incidental runoff from spray disposal. The preferred project description provides details on the sprayfield operations. Since only evapotranspiration would be used and only under controlled conditions and 100 foot setbacks from all drainages would occur, no significant impacts are expected.

Response to Comment A4-10

This comment stated that removing the existing septic tanks by excavation would result in potentially significant impacts. The comment suggests that the septic tanks be abandoned in place. Proposed Project 1, identified in the Draft EIR, which includes the STEP/STEG collection system, would require the removal of the existing septic tanks to install the new tanks only in those situations where there is not sufficient room to install a new tank. The environmental impact associated with this removal was evaluated in Section 5 of the Draft EIR. With the gravity collection system in Proposed Projects 2 through 4, identified in the Draft EIR, as well as the Preferred Project, the existing septic tanks could be abandoned in place.

Response to Comment A4-11

This comment expresses a desire for the inclusion of Low Impact Development (LID) Methodologies in the mitigation measures. The various elements of the project that produce new impervious surfaces include pump stations located outside of existing paved streets, access driveways to these facilities (such as at Broderson) and facilities at the treatment plant site. As part of the final design process

for nitrification/denitrification processes due to 3.5 times higher nitrogen in the incoming flows (app B pg. 5-7, last paragraph). The table in Appendix K pg. GHG-8 shows identical methanol inputs and therefore GHG consequences of projects 1 and 4. This table feeds into the summary analysis of GHG emissions. This appears to be an inconsistency. P22-17 CONT

d. The standard used in the DEIR for assessing the significance of GHG emissions effectively ignores all construction emissions as inherently insignificant, since AB32 compares 1990 emissions with 2020 emissions. (App K, pg 5.9-69, paragraph 2) This seems like a clear example of following the letter of the law and not the spirit, and it would be unfortunate if this becomes the standard analysis approach for CEQA. The law was enacted because GHG emissions create long lasting disruptive effects on our climate. It is cumulative emissions over time that causes the problem. In this project, the differences in construction emissions between projects are relatively small. But as a CEQA approach, it seems misguided to only consider differences in ongoing operational emissions and ignore differences in total (short and long term) GHG emissions between project alternatives. P22-18

CITY OF SCOTTS VALLEY
WASTEWATER TREATMENT FACILITY
ANNUAL REPORT 2008

Plant Summary and Compliance

We are proud to report that for the ninth straight year, the City did not record a single discharge violation. For the year 2008, effluent suspended solids averaged 9.0 mg/L (a 96.5% removal rate), effluent cBOD's averaged 3 mg/L (a 98.3% removal rate), and effluent BOD's averaged 5 mg/L (a 98.2% removal rate). Our compliance record is a direct result of a very knowledgeable and dedicated treatment plant staff that takes pride in their work and protecting the environment.

Recycled water usage reached a new high as a total of 48.14 million gallons of recycled water was used for irrigation at local parks, schools and residences in 2008. The Scotts Valley Water District continues to pursue additional recycled water users so we anticipate increased usage again in 2009.

We said goodbye to Robert Huber in 2008. Robert has been the plant's Senior Laboratory Analyst for the past 23 years! Robert left in July to retire in Colorado, however, he's only quasi-retired as he stays busy teaching at a local college. A couple of important acknowledgements are warranted in Robert's immediate absence. First, Operator II, Mark Cattera jumped in and took over the lion's share of the laboratory duties while the City recruited for a new Senior Lab Analyst. Mark has been with the City for 27 years and his cross training in operations and laboratory served himself and the City well during this transitional period. Secondly, we would like to acknowledge Interim Laboratory Director Robert (Bob) Barrett. Bob is a recently retired manager from the City of Santa Cruz Water Quality Laboratory who has been working for Scotts Valley on a contract basis until the City hired a permanent Senior Lab Analyst. Bob's experience and leadership skills have been a real asset to the City as Bob not only oversees all laboratory functions, including reporting and ELAP certification, but Bob played a key role in the recruitment process for the Senior Lab Analyst position. To complete this story, we are pleased to report that the City hired Kathleen (Kati) King as the City's new Senior Laboratory Analyst. Kati started as of the first of 2009 and comes to the City with many years of experience working in a local private laboratory.

A portion of the City's effluent force-main had to be relocated in 2008 to make way for a new pedestrian bridge that the City of Santa Cruz constructed. The City's 12-inch force main pipe travels 7.5 miles from Scotts Valley to Santa Cruz before discharging into the Pacific Ocean. To accommodate the new bridge that now spans the San Lorenzo River we had to relocate approximately 150-feet of pipeline at the end of Felker Street on the river levee. It took a complete plant shut-down for seven hours to allow the contractor the time needed to cut into the existing pipe and divert flow to the newly installed section. During the shut-down, plant flow was stored in the emergency storage cells of

McCampbell Analytical, Inc.
1534 Willow Pass Road
Pittsburg, CA 94565
ELAP Certificate No. 1644

Bioassay Testing:

Aquatic Testing Laboratories
4350 Transport Street, Unit 107
Ventura, CA 93003
ELAP Certificate No. 1775

Annual HVWS:

California Department of Fish and Game
2005 Nimbus Road
Rancho Cordova, CA 95670
ELAP Certificate No. 1622

Frontier Analytical Laboratory
5172 Hillsdale Circle
El Dorado Hills, CA 95762
NELAP Certificate No. 02113CA

Lift Stations

The City of Scotts Valley owns and operates seven lift stations at various locations throughout the City. All stations are inspected three times each week. During these routine inspections, hour readings are taken to verify normal running times and flow throughput, each pump is individually started and stopped to ensure proper operation, and wet-wells are visually inspected to confirm water levels with digital level reading on automatic pump controllers. Once each week, stations equipped with permanent emergency generators are tested on emergency power to ensure proper operation. Five stations are equipped with permanent emergency stand-by power. At this time, no other stations require permanent on-site emergency power, as limited flows allow ample time for City staff to respond to alarm conditions and provide portable generator power prior to overflows occurring.

All of the City's seven stations have back-up pumps and alarm systems that automatically call 24-hour emergency personnel in case of a power outage or high-level conditions.

Collection System

Staff responded to two overflows in 2008. On January 9, crews responded to an overflow at 560 Bethany Drive. A manhole in front of the maintenance shop at Bethany Bible College was seeping water. The small spill was estimated at 15 total gallons and a hydro-jet truck was used to clean the line. The second spill was located at a private residence at 121 Sunset Terrace Drive and was estimated at 90 gallons. Crews cleared the partial blockage with a hydro-jet truck.

The City's sanitary sewer collection system is made up of approximately 40 miles of pipeline. City crews spend an average of one to two days each week performing preventative maintenance, using a combination vacuum/hydro-jet truck to clean the lines.

Source Control Program

Industrial:

There are two significant industrial users remaining in the City of Scotts Valley, AVIZA Technology Inc. and ThermoFisher. Both are categorical industries with AVIZA a semiconductor manufacturer (40 CFR 469.18) and ThermoFisher (formerly Thermo Kevex) a metal finisher (40 CFR 433.15).

AVIZA self-reported excursions in metals and total toxic organics during 2008, but upon further examination of the reports it was realized that it was an error in units calculations. The analytical laboratory reported both metals and volatile compounds in micrograms/liter, but AVIZA had reported the values in milligrams/liter. Several of the industrial processes that previously discharge to the sanitary sewer are no longer in operation (six of the nine processes are currently inactive). Industrial wastewater discharges from this site have decreased dramatically.

ThermoFisher had one excursion for nickel in their wastewater discharge exceeding their permitted effluent limit during the second quarter of 2008. No interference or upset was caused at the WWTF. The City was notified and the resample of the effluent was within permissible limits.

Groundwater Remediation: There is now a groundwater pump and treat site discharging to the sewer in the City of Scotts Valley, under a permit. The responsible parties for the site are Shell Oil Products US and ConocoPhillips, and the treatment system and reporting is managed by Delta Consultants. Discharge began on March 7, 2008. The site has met all permit conditions to date.

All categorical industries and the groundwater pump and treat site in the City were monitored and permitted through the pretreatment program in 2008.

Grease Trap Installation and Maintenance:

TABLE 1

2008 PLANT FLOW AND RAINFALL

	Total Flow Million Gallons	Effluent Daily Flow MGD	Total Plant Flow MGD	Effluent Inst. Max. MGD	Recycled Total Flow Million Gallons	Rainfall Inches
January	36.731	1.182	1.185	3.93	0.102	19.82
February	32.330	1.114	1.115	3.84	0.021	7.53
March	27.709	0.807	0.894	3.81	2.680	0.34
April	25.133	0.716	0.838	3.74	3.656	0.40
May	24.616	0.583	0.794	2.35	6.556	0.00
June	24.457	0.547	0.815	2.42	8.047	0.00
July	24.268	0.525	0.783	2.23	8.005	0.00
August	24.566	0.571	0.792	2.35	6.879	0.00
September	24.131	0.606	0.804	3.40	5.962	0.00
October	24.857	0.661	0.802	2.38	4.382	1.73
November	25.883	0.824	0.863	2.83	1.156	5.31
December	26.176	0.826	0.844	2.30	0.579	4.64
Total	320.857				48.025	39.77
Average	26.738	0.747	0.877	2.97	4.002	3.31
Maximum	36.731	1.182	1.185	3.93	8.047	19.82
Minimum	24.131	0.525	0.783	2.23	0.021	0.00

ADDWF, MGD including recy.	0.798

The following is a partial list of sewer overflows in San Luis Obispo County in the past two years showing that conventional gravity sewers are a significant cause of pollution, especially during wet weather when high levels of inflow and infiltration surcharge the system.

Raw Sewage Spill Closes Local Beach

Jan 8, 2009 at 2:40 AM PST

Environmental Health Services has issued a precautionary beach closure in Shell Beach after a raw sewage spill.

Sewage Spill Prompts Warning

Jan 20, 2010 at 9:23 AM PST PISMO BEACH –

A sewer main backup Tuesday afternoon caused an overflow of about 700 gallons of raw sewage to spill in Pismo Beach. The spill occurred on Baker Avenue and flowed down to Naomi Avenue, and eventually entering the storm drain on Seacliff Drive in the Shell Beach area. City crews...more repaired the sewer main and are working to disinfect the spill area. As a precaution, County Environmental Health Services is advising the public to avoid ocean water contact along the beach area below the spill.

Health Officials Are Looking Into Sewage Spill in SLO

Feb 3, 2009 at 10:48 PM PST

30,000 gallons of sewage was released out of a sewer pipe at 7:00 a.m. Tuesday morning at Orcutt Road and Lawnwood Drive.

Beach Advisory Lifted After Sewage Spill

Feb 4, 2009 at 8:45 PM PST

Health officials have lifted an advisory at Avila Beach, following the sewage spill they feared by they feared may have contaminated the water.

Sewage Spill

Feb 14, 2009 at 11:11 PM PST

A sewage spill into the Cayucos creek.

Sewage Spill Behind Atascadero City Hall

Jan 20, 2010 at 5:36 PM PST

Atascadero-

According to a news release issued by the County of San Luis Obispo, the City of Atascadero experienced a sewer main blockage and overflow today at 9:50 AM. The overflow of approximately 25,000 gallons of raw sewage came out of a sewer manhole located behind the City of Atascadero's...more Government Center/City Hall, and then flowed into a storm drain that empties into Atascadero Creek. City crews had repaired the sewer main by 11:30 AM and then disinfected the spill area.

Major sewage spills in San Luis Obispo County

December 19, 2010

Health officials are warning the public to stay away from San Luis Obispo Creek, Arroyo Grande Creek, Meadow Creek, Oceano Lagoon and places where the creeks drain into the ocean because of two wee

The catastrophic failure of a six inch pump line at the San Luis Obispo Reclamation Plant on Prado Road on Saturday evening resulted in the release of about 15,000 gallons of sewage into San Luis Obispo Creek.

A second sewage spill occurred when the effluent pump at the South San Luis Obispo Sanitation District failed. As a result, clogged sewage lines caused the release of an unknown quantity of sewage.

The plant is currently using a large diesel power pump in place of the failed effluent pump. "Sewer lines are backed up and sewage is bubbling out of manhole covers," said John Wallace, the district's adm

The San Luis Obispo County Health Agency said that contact or ingestion of the contaminated waters is likely to make one sick.

County supervisors call emergency meeting

December 27, 2010

The San Luis Obispo County Board of Supervisors will have an emergency meeting Tuesday, Dec. 28 at 9 a.m.

Tuesday's meeting, scheduled to last only 45 minutes, is intended for county staff to update the supervisors on recent storm damage and actions taken to restore roads and other local infrastructure.

The supervisors will also be asked to extend the Proclamation of Local Emergency issued by county administrator Jim Grant on Dec. 21. County code requires the supervisors to review the situation every two weeks once an emergency has been declared.

San Luis Obispo South County Sanitation District (SSLOCSD) have allegedly under-reported the amount of raw sewage spilled during recent rainstorms in an effort to protect an agency already being accused of firing whistleblowers.

On December 18, a sewage spill of between 110,000 gallons to approximately one million gallons occurred when the influent pumps at the plant failed. Critics contend the failure could have been avoided if the Oceano plant had repaired a failing electrical system.

Sewage Spill in San Luis Creek

Posted: Jan 02, 2011 6:55 PM PST

Updated: Jan 02, 2011 6:55 PM PST 1.2.11

SAN LUIS OBISPO- San Luis Obispo County Officials are warning people to stay out of San Luis Creek. A sewage spill was reported this afternoon near Windsor Boulevard and Shammel Park. A waste water system that was overloaded by excessive rain caused the 15,000 gallon spill. People are being advised to also stay out of Chorro Creek, Morro Bay Estuary and Morro Bay. Sport shellfish harvesting in the estuary is also prohibited until further notice.

Updated: Feb 03, 2011 7:30 PM PST

MORRO BAY - It's safe to eat shellfish again.

The San Luis Obispo County Public Health Department has lifted the quarantine on recreational sport-harvesting of bi-valve shellfish... including clams, mussels and scallops. The ban was put in place on December 21st and covered the entire bay, from Morro Rock to the southern end of the bay. On Sunday December 19th, following heavy rain, a tree fell on an above ground sewer line at Cuesta College.... causing a dangerous health threat.

The broken line allowed 50,000 gallons of sewage to spill into Chorro Creek, which empties into the Morro Bay Estuary. Eating contaminated shellfish can make a person very sick with viruses and bacteria.ally vulnerable to these waterborne pathogens.

The following occurred between about December 1, 2010 and December 30, 2010

MORE SEWAGE LEAKS OCCUR DURING THE STORM

Even more sewage was released into the water ways around the county during Monday's storm. In San Luis Obispo, 1,000 gallons spilled into San Luis Creek at the intersection of Pismo and Toro streets. In Morro Bay, about 500 gallons

were released into a storm drain at Main and Nassau Streets. In Pismo Beach, 750 gallons spilled into a storm drain at Morro and Ocean streets. And in Avila Beach 2,500 gallons was spilled from a lift station at First Street and San Miguel Avenue. The total is just less than 5,000 gallons of raw sewage released into the four cities.

TREE FALLS ON SEWER LINE, CLOSING CUESTA COLLEGE

The Cuesta College campus closed yesterday due to a sewage spill. A tree on the adjacent Camp San Luis toppled Sunday and damaged a bridge over Chorro Creek and severed the college's sewer line. The severed line was tapped and turned off. The college maintenance and operations department is working with Camp San Luis personnel to repair the line. There are no students on campus and a reduced number of staff is working due to winter break.

PUBLIC HEALTH DEPARTMENT: STAY OUT OF THE OCEAN

The San Luis Obispo County Public Health Department says to stay out of ocean water for at least three days after significant rainstorms. Rainstorm runoff is known to transport high levels of disease causing organisms such as bacteria and viruses originating from the watershed. These organisms carried into the ocean can cause skin, respiratory, and intestinal problems. People with compromised immune systems, plus the very young and elderly age groups are especi Shellfish Quarantine Lifted

LOS OSOS
NITRATE MONITORING PROGRAM

October 2006
GROUND WATER MONITORING

Prepared for the

LOS OSOS COMMUNITY SERVICES DISTRICT

December 2006

CLEATH & ASSOCIATES
1390 Oceanaire Drive
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Table 1
October 2006 Ground Water Elevations
LOCSD Monitoring Well Network

Well ID	Location	Type	Depth (ft)	Perforated interval (ft)	Well diam. (in)	R.P. Elev. (ft)	Water Depth* (ft)	Water Elevation (ft)
30S/10E								
13G	South Court	CSD mon	52	47-52	2	50.95	39.33	11.6
13H	Broderson/Skyline	CSD mon	34	29-34	2	49.33	25.79	23.5
13L5r	Howard/ Del Norte	CSD mon	37	26-36	2	32.63	21.50	11.1
13Q1r	Woodland Dr.	CSD mon	105	95-105	2	101.27	83.58	17.7
24A	Highland/ Alexander	CSD mon	164	154-164	2	193.04	154.17	38.9
30S/11E								
7Kr	12th/ Santa Ysabel	CSD mon	70	55-65	2	90.71	51.17	39.5
7L3r	Santa Ysabel/ 5th	CSD mon	50	40-50	2	45.76	36.46	9.3
7N1	3rd St.	CSD prod	83	61-71, 73-83	8	na	6.25	--
7Q1	El Moro/ 8th St.	CSD mon	75	29-43, 54-75	8	25.29	2.67	22.6
7R1r	El Moro/ 12th St.	CSD mon	35	25-35	2	61.93	21.00	40.9
8Ma	Sta. Ysabel/ South Bay	CSD mon	45	35-45	2	na	39.83	--
8Mb	South Bay/ 18th St.	CSD mon	47	37-47	2	na	40.17	--
8N2r	South Bay/ El Moro	CSD mon	50	40-50	2	95.99	34.35	61.6
17D	Pismo / 18th	Private	120	na	10	na	na	--
17E9	Nipomo / South Bay	CSD mon	204	184-194	2	105.85	91.50	14.4
17F4	Hollister Lane	Private	72	48-72	8	78.57	na	--
17N4	Willow Dr.	Private	60	40-60	6	162.61	20.75	141.9
18A	San Luis Ave	Private	na	"Shallow"	6	na	--	--
18B1r	Ramona Ave./10th St.	CSD mon	35	25-35	2	79.89	17.83	62.1
18C1r	Pismo Ave / 5th St	CSD mon	35	25-35	2	34.55	16.21	18.3
18E1	Ramona/private road	Private	100	40-60	6	39.61	24.00	15.6
18J6r	Los Olivos/ Fairchild	CSD mon	35	25-35	2	125.74	19.50	106.2
18L3r	Palisades Ave.	CSD mon	55	43-53	2	88.02	38.58	49.4
18L4r	Ferrell Ave.	CSD mon	35	25-35	2	103.85	19.52	84.3
18N1r	Manzanita/ Ravenna	CSD mon	95	85-95	2	125.53	72.63	52.9
18R1	Los Osos Valley Rd.	Private	50	40-50	8	170.96	10.50	160.5
20B	Eto Lane	Private	na	"Shallow"	4	na	--	--
21D	Sombrero	Private	116	na	8	na	10.25	na

Notes: *See Table 3 for specific dates.
Well ID's ending with "r" are replacement wells.
Elevations in feet above mean sea level
R.P. = reference point
CSD = Los Osos CSD
na = not available

Estimated ground water flow directions and hydraulic gradients for first water are shown in Figure 1. Ground water on the West side is inferred to flow to the northwest at an estimated average hydraulic gradient of 0.014 vertical feet of head loss per horizontal foot of distance (ft/ft) beneath Redfield Woods and Cuesta-by-the-Sea, and as low as 0.003 ft/ft beneath Sunset Terrace. On the East side, ground water is inferred to flow to the northwest toward the bay from downtown Los Osos, shifting to a westerly flow direction across Baywood Park. Shallow water beneath the easternmost portions of Los Osos/Baywood Park flows to the east and northeast toward Los Osos Creek. A ground water high is inferred across

Table 3
October 2006 Water Quality Results

Well ID	Sample Date	Temp ° C	pH-field units	TDS mg/l	EC µmhos/cm	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	HCO3 mg/l	SO4 mg/l	Cl mg/l	NO3-N mg/l	B mg/l	DTW feet
30S/10E-13G	10/18/06	17.6	6.15	260	420	18	17	0.9	35	64	10	63	10	0.06	39.33
30S/10E-13H	10/19/06	18.8	6.75	250	230	20	12	2.1	16	50	16	23	2.6*	<0.05	25.79
30S/10E-13L5	10/20/06	19.3	5.89	1400	2400	100	110	1.3	170	85	59	680	11*	0.20	21.50
30S/10E-13Q1	10/27/06	18.9	6.09	450	820	33	24	1.5	74	65	26	140	18	0.10	83.58
30S/10E-24A	10/31/06	18.2	6.30	220	350	13	10	1.1	37	42	5.2	51	11	0.11	154.17
30S/11E-7K	10/26/06	19.2	6.97	350	650	26	25	1.3	46	140	47	77	11	0.11	51.17
30S/11E-7L3	10/24/06	18.8	6.63	550	930	35	30	2.3	110	140	67	120	23	0.24	36.46
30S/11E-7N1	10/18/06	17.5	7.24	150	250	13	9.7	0.9	21	60	6.2	31	2.9	<0.05	6.25
30S/11E-7Q1	10/18/06	18.5	6.42	430	740	32	25	4.5	65	85	44	100	21*	0.18	2.67
30S/11E-7R1	10/26/06	17.9	6.33	350	640	30	19	2.3	50	130	44	69	13	0.16	21.0
30S/11E-8Ma	10/25/06	19.4	7.00	440	830	130	140	17	44	100	20	180	4.2*	0.86	39.83
30S/11E-8Mb	10/25/06	18.7	6.84	450	720	87	110	14	59	150	36	83	18*	0.79	40.17
30S/11E-8N2	10/27/06	18.2	6.40	57	100	4.6	4.3	0.8	8.2	25	4.7	8.3	1.2	<0.05	34.35
30S/11E-17D	10/24/06	21.0	6.36	280	520	19	16	1.4	54	72	24	60	17	0.14	na
30S/11E-17E9	10/31/06	18.6	6.57	330	540	29	25	1.4	40	100	17	70	13	0.09	91.50
30S/11E-17F4	10/26/06	19.3	6.22	310	570	26	24	0.6	59	140	13	92	0.6	0.06	na
30S/11E-17N4	10/25/06	17.9	5.95	200	320	12	11	0.8	31	40	13	43	5.6	<0.05	20.75
30S/11E-18A	10/26/06	19.3	6.35	270	490	23	16	2.5	53	85	31	57	11	0.23	na
30S/11E-18B1	10/26/06	17.6	6.35	250	470	28	15	5.7	37	110	18	50	7.0	0.19	17.83
30S/11E-18C1	10/24/06	18.0	6.22	360	670	29	26	1.6	61	120	39	84	14	0.13	16.21
30S/11E-18E1	11/01/06	17.7	6.34	240	450	20	16	1.4	42	84	21	58	7.9	0.10	24.00
30S/11E-18J6	10/19/06	20.9	6.34	390	630	46	32	5.9	52	190	22	70	1.9*	<0.05	19.50
30S/11E-18L3	10/20/06	18.9	6.38	210	370	18	11	2.1	33	50	21	49	5.9	0.09	38.58
30S/11E-18L4	10/24/06	19.0	6.09	350	660	31	25	3.3	51	110	32	84	14	0.12	19.52
30S/11E-18N1	10/27/06	19.0	6.03	420	780	27	25	1.7	61	38	26	140	20	0.12	72.63
30S/11E-18R1	11/01/06	17.5	5.90	350	630	27	22	0.8	58	60	22	110	18	0.17	10.5
30S/11E-20B	10/25/06	16.8	6.48	340	610	28	30	1.0	44	95	24	98	6.0	<0.05	na
30S/11E-21D	10/25/06	17.3	6.89	780	1300	87	90	0.5	78	500	94	100	4.8	0.16	10.25

*other forms of nitrogen detected - see lab sheets. Note: HCO3 reported as mg/l CaCO3. DTW = depth to water.

The interpretation of long-term trends was conducted visually from the graphs. Nineteen wells show no discernable active long-term trends of increasing or decreasing NO_3-N and TDS concentrations. Three wells had records considered too short for interpretation. Two wells showing long-term trends in the April 2005 review have since reversed. Active long-term trends for the remaining six wells in the monitoring network are noted below.

1)	30S/10E-13G	Decreasing TDS concentrations since 2002
2)	30S/10E-13L5	Increasing TDS concentrations since 1996
3)	30S/11E-7L3	Increasing NO_3-N concentrations since 2002
4)	30S/11E-7Q1	Increasing NO_3-N concentrations since 1982
5)	30S/11E-8N2	Decreasing TDS concentrations since 2002
6)	30S/11E-18R1	Increasing TDS concentrations since 1994

Measurements of TDS and water levels over time suggest a correlation between the two parameters on a network-wide basis. Those monitoring events with the highest composite ground water elevations generally have the lowest average TDS (and vice-versa). This relationship would be expected, since percolating rainfall raises water levels and has a low TDS compared to ground water. Nitrate concentrations do not correlate in similar fashion.

Water quality measurements at monitoring network wells for October 2006 indicate a relatively stable salt load when compared to prior monitoring results. The average TDS of network monitoring wells has ranged between 333 mg/l and 375 mg/l, and is currently 373 mg/l.

CONCLUSIONS

Shallow ground water generally flows to the northwest toward the bay. On the east side of the basin, a portion of the shallow water moves toward Eto Creek and Los Osos Creek. The ground water flow pattern for October 2006 is similar to historical flow patterns. Water levels averaged 1.2 feet lower in October 2006 compared to April 2006.

Short-term water quality trends include a decrease in average nitrate concentrations and an increase in average TDS concentrations since the April 2006 monitoring event. The number of monitoring network wells with water quality in excess of the NO_3-N drinking water standard of 10 mg/l is presently 15 out of 28 wells tested. Water quality trends mostly involve seasonal fluctuations, with occasional long-term trends of increasing or decreasing salinity. The long-term water quality trends are interpreted to indicate that general mineral concentrations in shallow ground water are close to equilibrium conditions under the current land uses and septic discharges, which have been relatively stable since the 1980's.

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LOS OSOS
NITRATE MONITORING PROGRAM

APRIL 2005
GROUND WATER MONITORING

Prepared for the

LOS OSOS COMMUNITY SERVICES DISTRICT

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CONCLUSIONS

Shallow ground water generally flows to the northwest toward the bay. On the east side of the basin, a portion of the shallow water moves toward Eto Creek and Los Osos Creek. The ground water flow pattern for April 2005 is similar to historical flow patterns. Water levels averaged 4 feet higher in April 2005, compared to October 2004, and were the shallowest since 1998 for most of the network monitoring wells

Water quality results at network wells for April 2005 indicate a decline in shallow ground water salinity compared to the results obtained in October 2004. NO_3-N and TDS concentrations in water collected from network wells across the basin decreased an average of 0.6 mg/l and 42 mg/l, respectively, over the last quarter. The number of monitoring network wells with water quality in excess of the NO_3-N drinking water standard of 10 mg/l has declined from 14 wells in October 2004 to 12 wells in April 2005. *

Water quality trends mostly involve seasonal fluctuations, with occasional long-term trends of increasing or decreasing salinity. Water quality trends are interpreted to indicate that general mineral concentrations in shallow ground water are close to equilibrium conditions under the current land uses and septic discharges, which have been relatively stable since the 1980's. *

Nitrates and other trace elements are at equilibrium in the upper aquife.

DRAFT FINAL REPORT

SEA WATER INTRUSION ASSESSMENT
and
LOWER AQUIFER SOURCE INVESTIGATION
of the
LOS OSOS VALLEY GROUND WATER BASIN
SAN LUIS OBISPO COUNTY, CALIFORNIA

prepared for the

LOS OSOS COMMUNITY SERVICES DISTRICT

with grant funding provided by the

CALIFORNIA DEPARTMENT OF WATER RESOURCES

July 2005

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much of the sea water mixing beneath the sand spit may have already been in place prior to any basin development.

Zone C hydraulic heads near the bay at Pecho Road have generally been in excess of 5 feet above sea level, based on static water level data from community supply well 30S/10E-13L1 (140 feet deep, drilled in 1955), except between 1989 and 1995, due to the effects of the late 1980's drought. Well 13L1 was placed on standby status in the late 1990's due to increasing nitrate concentrations, and is currently idle. Water levels at well 13L1 have generally been between 8 and 9 feet above sea level in recent years.

Zone C hydraulic heads have historically been in excess of 2.5 feet above sea level along the bay at Pasadena Drive except during severe drought, based on static water level data from community supply well 30S/11E-7N1 (84 feet deep, drilled in 1951). During and following the 1976-77 and 1987-1990 drought periods, static water levels in well 7N1 dropped to below sea level. Water levels in recent years have generally been between 5 and 6 feet above sea level at Well 7N1, which is still in active service.

In 1998, shallow water table monitoring wells were installed at Sea Pines golf course for wastewater discharge monitoring (RWQCB file review for Waste Discharge Order 93-82). Water levels at monitoring well MW3, on the west side of the golf course property, averaged 3.8 feet above sea level between October 2001 and July 2004, which is slightly lower than the hydrostatic requirements of the Ghyben-Herzberg relation (4.5 feet of head) to avoid sea water intrusion through a depth of 180 feet below sea level. As mentioned previously, however, the Ghyben-Herzberg relation would underestimate the depth to the sea water interface under ocean outflow conditions, and while the potential correction is negligible for relatively flat hydraulic gradients, it becomes significant as the outflow face is approached at the bay.

The Zone C sea water interface is currently estimated to be relatively stable onshore, with a potential for active intrusion beneath the sand spit, based on the observed hydraulic pressures and seaward hydraulic gradient. During extended drought periods, however, there is a potential for onshore sea water intrusion in Zone C, although no significant impacts to supply wells have been reported. One example of sea water intrusion near the bay was reported in a shallow well during the 1960's (DWR, 1972). The well (30S/10E-13B2) was only 20 feet deep, however, is interpreted to have been intruded by brackish water from the bay. *

The earliest water level information in Zone D near the bay is from well 30S/10E-13L4, drilled in 1977. The first water level reported in May 1977 at this well was equivalent to approximately 7 feet above sea level. Under hydrostatic conditions, this would theoretically maintain fresh water saturated sediments through approximately 280 feet below sea level (Zone D extends to 320 feet below sea level at well 13L4). The e-log of the test hole, however, indicated saline water beginning at approximately 520 feet below sea level. Therefore, either sufficient ocean outflow through the aquifer zones was present in 1977 to maintain an equivalent fresh water head of 13 feet at depth, or active sea water intrusion was occurring by 1977.

The upper aquifer is only relatively stable and subject to seawater intrusion.

2005 Sea Water Intrusion Assessment

Creek. The Morro Group (1989, cross-section F-F', page B-5) also showed the aquitard outcropping along the west bank of Los Osos Creek, upstream of Los Osos Valley Road. A concurrent investigation by the U.S.G.S. (Yates and Wiese, 1988, cross-section A-A', pages 8, 9, and 16) identified and correlated continuous clay layers in two areas, one layer up to 20 feet thick between Los Osos Creek and downtown Los Osos, and the other layer 50 to 80 feet thick west of the north-south extension of Ninth Street.

A lower aquifer water level contour map for Fall 1984 was prepared based on the above historical interpretation by the Morro Group (1987 EIR, Volume II, Figure C-3.4). This map showed deep aquifer water levels below sea level from the coast through Ferrell Avenue. East of Ferrell Avenue, lower aquifer water levels were shown above sea level and increasing in elevation up to the invert level of the Los Osos Creek channel. Many of the wells on the east side of Ferrell Avenue used for preparation of the Fall 1984 lower aquifer water level contour map, however, have since been reinterpreted as upper aquifer wells.

In the mid 1990's, the Morro Group prepared cross-sections for Metcalf & Eddy (unpublished) and a map of elevation contours on the base of the regional aquitard (EDA and Morro Group, 1997) that differed from the original 1987 EIR interpretation. Specifically, the perching clay that extends from Bayview Heights though downtown Los Osos was interpreted as separate from the regional aquitard. It was recognized that the perching clay (AT1 clay) outcrops along the banks of Los Osos Creek, while the regional aquitard subcrops further to the east beneath the creek valley alluvium. In fact, the perching clay had been previously studied during development of Bayridge Estates and correlated with the outcrops along Los Osos Creek (Wiese, 1974).

In 2001, Weber, Hayes & Associates investigated the perched aquifer beneath a portion of downtown Los Osos, and identified three discrete hydraulic zones, which they named Zones A, B, and C. The work by Weber, Hayes & Associates confirmed the existing interpretation regarding the depth of the perching clay, and the nomenclature for the aquifer zones was expanded by Cleath & Associates (2003) to include Zones D and E. The current interpretation of the regional aquitard structure on the east side, including the creek valley, is shown in Figure 21 (Detail of Hydrogeologic Cross-Section B-B').

Los Osos Creek Valley

A main source of recharge to the lower aquifer has historically been considered to be Los Osos Creek and the creek valley sediments. The Morro Group (1987, 1989) focused on the upper creek valley as the most likely location for recharge from stream seepage, with supporting evidence from possible fracture conduits along the Los Osos fault near the juncture of Strand A and Strand B, from ground water mounding in the upper creek valley area, and from the former structural interpretation of the regional aquitard as absent east of the creek. Stream seepage had been measured in the upper creek valley during portions of 1986, and was estimated to average 1.1 acre-feet per day.

SIMULATED EFFECTS OF A PROPOSED SEWER PROJECT ON NITRATE CONCENTRATIONS IN THE LOS OSOS VALLEY GROUNDWATER BASIN

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November 6, 2003

of shunting some of the rainfall and irrigation-return-flow recharge to Willow Creek and to the edges of the clay layer. Thus, it was reasonable to incorporate its effects in the recharge preprocessor.

Soil Moisture Budget

The recharge preprocessor simulates the deep percolation of infiltrated rainfall and applied irrigation water past the root zone, plus percolation of septic system leachate. It also simulates nitrogen mass and concentration accompanying the recharge. These calculations are completed for each of a number of geographic zones representing different combinations of land use, soil type and rainfall. The zonation is conceptually similar to the zonation used in the USGS and URS models, but the boundaries and parameters of the zones were redefined for the present model. For example, separate zones were created for horse ranches because of their unique nitrogen loading characteristics. A map of the recharge zones used in the present model is shown in Figure 3. These 44 zones were delineated at a scale of 1:12,000 on an orthorectified digital air photo mosaic developed from air photos taken in 1999 and currently used by San Luis Obispo County planning staff (Rosenberg pers. comm.). The zones were then transcribed to the groundwater model grid. Because each model cell covers 1.4 acres, the zone areas in the model could be matched to the digitized zone areas only to within about +/- 1.4 acres. The large number of zones is partly the result of subdividing zones around the perimeter of the perching clay layer as described in the "Perching Layer Effects" section below.

Each recharge zone is defined by a suite of variables that define rainfall, runoff, evapotranspiration, irrigation, soil moisture storage, and nitrogen sources. These parameters are listed in Table 1 for each of the zones. These parameters include area, soil characteristics (available water capacity), presence of perched zone, the number of units for point-source nitrogen loads, and percent of area in each of nine land-cover categories. Surface permeability and available water capacity of the three principal soil types in the basin (Baywood fine sand, Salinas/Marimel silty clay loam, and Concepcion loam with clay subsoil) were obtained from the county soil survey (U. S. Soil Conservation Service 1984). Table 2 lists the gross and net nitrogen loading factors for point-source nitrogen loads. Table 3 shows parameters associated with each land cover category, including root depth, irrigation status, monthly ET crop coefficients, and per-acre nitrogen load from nonpoint sources.

The preprocessor simulates the soil moisture budget on a daily basis using a time series of daily rainfall and reference ET (ETo). Daily rainfall data for Morro Bay Fire Department station were converted to estimated rainfall at the South Bay Fire Department station, for which daily data were not readily available in digital format. To convert, Morro Bay rainfall was multiplied by 1.05, which is the regression slope for monthly data (r-squared = 0.92) as shown on Figure 4. Rainfall for each zone was obtained using a multiplier equal to the ratio of average annual rainfall at the zone to average annual rainfall at South Bay Fire Department, using the same isohyetal map that was used for the 1988 USGS study. ETo in Los Osos was estimated by adjusting measured daily ETo at the CIMIS station in San Luis Obispo for coastal fog gradient effects. The gradient was represented by the monthly ratios of average ETo at three coastal CIMIS stations (Santa Barbara, Castroville and De Laveaga) to average ETo in San Luis Obispo.

Runoff is simulated as a linear function of rainfall. Above a specified threshold of daily rainfall, a specified percentage of the excess rainfall is estimated to become runoff. This simplified algorithm tends to produce isolated pulses of runoff that typically do not match gaged streamflow well on a daily basis but with appropriate slope and intercept values simulates monthly and longer-term runoff reasonably well. In this case, the slope and intercept values for the runoff equations for each of the soil types were obtained from a similar soil-moisture-budget model developed for the Laguna Seca area near Monterey, where gaged streamflows and groundwater hydrographs were used to calibrate the runoff parameters (Yates and others, 2002).

Runoff from many impervious surfaces in the Los Osos area flows to adjacent pervious, sandy soils. For low and moderate rainfall intensity, essentially all of that water percolates into the soil near the impervious area. This effectively concentrates the runoff in a small area, where it overwhelms soil moisture storage capacity, allowing a large percentage of the runoff to percolate past the root zone and become groundwater recharge. During periods of intense, prolonged rainfall, surface runoff flows to low areas, where it ponds and infiltrates more gradually. In several locations, stormwater pumping stations and/or storm drains convey the ponded water to Morro Bay or Los Osos Creek to avoid flood impacts (Engineering Development Associates and The Morro Group, 1997). For recharge zones in these areas, the fraction of runoff from impervious areas that recharges locally was decreased slightly to account for water removed by these drainage facilities.

Crop coefficients relating ET for each land cover category (vegetation type) to ETo were based on values developed from field studies and modeling in other central coast basins (Blaney and others, 1963; Smith pers. comm.; DWR, 1975; Yates and others 2002). In practice, crop coefficients for irrigated vegetation primarily affect the simulated irrigation frequency and depth, whereas deep percolation of applied irrigation water is more directly controlled by the assumed irrigation efficiency. For example, with an irrigation efficiency of 80%, a soil moisture deficit of 4 inches would be replenished with 5 inches of applied irrigation water, 1 inch (20%) of which is assumed to become deep percolation. Crop coefficients for nonirrigated vegetation strongly affect the rate at which stored soil moisture is depleted in summer, but not the total amount of depletion. They generally have a minor effect on the amount of deep percolation of rainfall in winter.

Deep percolation is assumed to occur when the soil moisture storage capacity is exceeded. Soil moisture storage capacity is directly proportional to the assumed rooting depth of plants, which is not well known. The estimates shown in Table 3 are consistent with previous modeling studies of coastal basins where more rigorous calibration was possible (Yates and Van Konynenberg 1998, Yates and others 1990, Yates and others 2002).

The recharge preprocessor simulated nitrogen loading associated with recharge in addition to the flow of water. Nitrogen can occur in any of several compounds in recharge flows and groundwater, and microbially-mediated reactions can transform one compound to another in the subsurface. To ensure that nitrogen mass is correctly simulated, the recharge preprocessor simulates nitrogen (as N) rather than nitrate (as NO_3). Nitrogen sources were divided into per-acre sources and non-per-acre sources. Per-acre sources included nitrogen loads from atmospheric deposition,

Results

Table 4 shows the average annual soil moisture budgets and nitrogen loads during 2000-2002 for the 44 simulated recharge zones. Simulated recharge rates ranged from 0 in/yr in areas of deep-rooted natural vegetation to 31.6 in/yr in a medium-density residential zone that receives additional recharge from the perching clay layer. Figure 5 shows a map of recharge rate (in inches per year) and reveals the expected "halo" effect created by the perching clay layer. Average recharge for the entire basin was 9.1 in/yr over 4,658 acres (which excludes Morro Bay), or 3,525 af/yr. Figure 6 compares this result with estimates from previous studies of the basin. Total recharge was similar to the estimate developed by URS (2000), in spite of the different methods used to obtain the estimates. The present result was between the 1970-1977 and 1986 estimates developed by the USGS (1988), which is reasonable given the lesser extent of development during 1970-1977 and the wet conditions during 1986. The present estimate is smaller than the total recharge estimates presented by Brown and Caldwell Consulting Engineers (1983), but those estimates also included recharge from Los Osos Creek and from bedrock inflow around the basin perimeter. Thus, the present estimate of overall recharge appears reasonable.

Maps showing the distribution of nitrogen in recharge (as concentration and as mass load) are shown in Figure 7, and corresponding data values are presented on the right side of Table 4. The patterns reveal that the zones that contribute large amounts of nitrogen mass are not necessarily zones with high nitrogen concentrations, although on a per-acre basis there is a slight correlation. For example, the largest loads, in pounds, are from medium-density residential and commercial land uses, both of which occupy many acres within the basin. On a per-acre basis (not shown in the table), horse ranches have the highest nitrogen loads, followed by medium-density residential areas and irrigated crops. Large loads are sometimes accompanied by large volumes of water, as in the case of septic system leachate. This results in low-to-moderate concentrations. Conversely, zones with small nitrogen loads -- such as natural vegetation -- can have high simulated concentrations because the load is dissolved into a small volume of recharge. The highest simulated concentrations were at the two horse ranches. Natural vegetation had the lowest average concentration (7.1 mg/l), and the developed land uses (including cropland) had concentrations in the 10-20 mg/l range.

Groundwater Pumping

Cleath and Associates supplied estimates of steady-state groundwater pumping for the 2000-2002 period. A steady-state rate was estimated for each municipal supply well in the basin, and additional assumed private wells were added for areas not served by water districts. Each private well pumps an assumed 890 gallons per day. Agricultural demands were based on crop factors and assumed cropped acreage. Table 5 displays the steady-state pumping rates for each municipal supply well, total steady-state pumping from private wells, and total steady-state pumping from agricultural wells.

The with-project steady-state flow system formed the basis of the 30 year with-project solute transport simulation. This simulation used with the same initial conditions as the existing-condition simulation. No increase in the number of animals was assumed, nor was the recharge file changed to reflect increased urbanization and population that would presumably accompany the 400 af/yr of additional water use, as the locations and amounts of those changes are speculative. Treated wastewater percolated at the effluent disposal sites had a nitrogen concentration of 7 mg/l, as stated by the treatment plant design engineers. Wastewater percolation was incorporated into the recharge values by creating eight new recharge zones at the effluent disposal site locations.

The recharge rates, nitrogen loads and nitrogen concentrations for all of the recharge zones in the with-project simulation are shown in Table 9. The table is comparable to the one presented earlier for existing conditions (Table 4), except for additional zones representing the percolation sites (zones 301 through 308) and a new column for wastewater percolation in each zone. A comparison of individual zones with existing conditions confirms that zones outside the sewer service area or with no septic systems have the same recharge and nitrogen values as under existing conditions. Also note that the perching clay layer disperses the recharge and nitrogen loading from three of the percolation sites.

Table 10 provides a summary comparison of nitrogen loading under existing and with-project conditions. Under existing conditions, 47% of the basinwide nitrogen load comes from septic systems. Septic system leachate also has the highest nitrogen concentration of any of the recharge sources, followed closely by recharge from cropland. The high mass and concentration for cropland are probably erroneous because they reflect a questionable assumption that fertilizer application on non-irrigated pasture and cropland is the same as on irrigated cropland. Because recharge rates are much smaller for non-irrigated fields, the calculated concentration is high (22 mg/l versus 13 mg/l). By coincidence, recharge in developed areas – excluding septic recharge and nitrogen from animals -- has the same concentration as recharge in natural areas. Developed areas include a moderate percentage of non-irrigated natural vegetation, but they also include irrigated landscaping, turf and weeds, all of which have higher nitrogen loading rates. It appears that the extra loading from those sources is diluted by runoff from impervious areas, which contains negligible nitrogen and most of which percolates through pervious soils adjacent to the impervious surfaces, thereby diluting the nitrogen load.

The total basinwide nitrogen load under existing conditions is 121,400 lb/yr, with an average recharge concentration of 11.0 mg/l. With the sewer project at buildout, the total load would be 98,500 lb/yr, with an average concentration of 8.1 mg/l. This represents a 19% decrease in basinwide nitrogen load. However, the buildout condition includes 400 af/yr more wastewater generation than under the existing condition. If treated effluent percolation in the buildout scenario is decreased by 400 af/yr for the purposes of comparison with existing conditions, the total load would be 91,000 lb/yr, or 25% less than under existing conditions.

Results

Figure 20 shows contours of simulated water levels in model layers 2, 4 and 5 with the

sewer project. The effects of the project can be seen by comparing these maps with the corresponding maps for existing (no-project) conditions (Figure 12). Because groundwater flow is simulated as steady-state, time is not a variable. Thus, there are only two flow regimes and two corresponding sets of water levels: with-project and no-project. There is no change in water levels during the 1983-2002 simulation or the 2003-2032 simulation; the only transient variable is nitrate concentration. The effects of the project are most noticeable in layer 2, where a large groundwater mound develops beneath the Broderson recharge site. Simulated groundwater elevations away from the Broderson site are generally lower under the with-project alternative, reflecting the increased pumping (from existing municipal wells plus the proposed harvest wells), and the decreased recharge from septic systems. Water levels at some locations are more than 10 feet lower than under the existing condition, which causes model layer 1 to go dry at those locations. Although perfectly realistic from a hydraulics standpoint, the dry areas cause abnormalities in the nitrate contour plots.

The four maps in Figure 21 show the simulated distributions of nitrate in Layers 1 and 2 after 30 years of simulation for the no-project and with-project alternatives. A comparison of the maps confirms that the sewer project results in lower nitrate concentrations throughout the sewered area in both layers. The white areas in layer 1 under with-project conditions (Figure 21B) are where layer 1 cells are dry. As discussed earlier, concentrations in layer 1 closely mirror the concentration of recharge, even if the recharge volume is small. For example, the "hot spot" near the end of Ferrell Avenue is in a low-density residential area (recharge zone 107, which also includes the residential area east of South Bay Boulevard), which has relatively high fixed loads (horses, dogs and cats) combined with only a small amount of recharge enhancement from infiltration of impervious area runoff. The no-project alternative results in a large area with nitrate concentrations above the maximum contaminant level (MCL) of 10 mg/l as N. With the exception of a few small areas, nitrate concentrations within the sewered area are reduced to concentrations below 10 mg/l with the sewer project in place. Nitrate variability is attenuated by dispersion as recharge moves down to layer 2, and hot spots are generally more subdued (Figure 21C).

The effect of the project on nitrate concentration in layer 2 is shown more explicitly in Figure 22, which is a contour map of differences in nitrate concentration between the no-project and with-project alternatives after 30 years of simulation. As expected, nitrate concentrations decrease throughout the sewered area. The one area of increased nitrate concentration west of Cabrillo Estates resulted from the Broderson recharge mound, which shifted the water-level gradient near the affected area to a westward direction, allowing existing nitrate-containing groundwater to flow into an area previously unaffected by Cabrillo Estates recharge.

Finally, Figure 23 shows the effects of the project on nitrate concentrations in municipal wells, most of which are deep (layers 4 and 5). The well are grouped by purveyor into three graphs for clarity. The results indicate that over the first 30 years of project operation, nitrate concentrations would likely decrease in some wells and rise in others. These mixed results reflect the complex interaction between the existing nitrate distribution, each well's future pumping rate, and the influence of nearby wells. As an example, the Cal-Cities Cabrillo well pumps considerably

more under the with-project alternative than under the no-project alternative. The simulated nitrate concentrations in the Cabrillo well are higher in the with-project alternative, possibly reflecting the greater pull this pumping imposes on nitrate already migrating towards this well. In contrast, S&T well #4 is not pumping in the no-project alternative, and the pumping imposed in the with-project alternative reduces the concentrations observed in this well. This is likely a result of the S&T well #4 changing the local flow patterns. In the no-project simulation, nitrate passively flows through the well location. Under the with-project simulation, S&T well #4 apparently pumps a combination of water with nitrate and relatively clean water, resulting in lower nitrate concentrations. If the simulation had been extended several more decades, nitrate concentrations at the increasing wells would reach a peak and then start to decline as the effect of the sewer project gradually spreads throughout the flow system.

CONCLUSIONS AND RECOMMENDATIONS

Key Conclusions

The single most important basin characteristic affecting water-quality trends in the Los Osos Valley groundwater basin is the slow turnover rate of groundwater. The volume of groundwater in storage is large relative to annual inflows and outflows. Two important conclusions can be drawn from this single characteristic without any modeling at all:

- any action to decrease nitrogen loading -- such as the proposed sewer project -- will take a long time to have an effect, and

- nitrate concentrations in some deep wells may continue to increase for many years before the effect of the action reaches those wells.

Some simple calculations will serve to illustrate this point. The area to be served by the sewer system is approximately 2,100 acres. This area is largely developed and is also the area where high nitrate concentrations are commonly found in the shallow groundwater system above the regional confining layer. The average saturated thickness of the shallow groundwater system in that area is about 120 feet, for a total aquifer volume of approximately 252,000 af. The effective porosity of the aquifer indicates the percentage of the total volume that is occupied by water in pores that moves as groundwater flow and/or dilutes pollutants. The effective porosity is probably in the 0.15-0.20 range, which corresponds to a groundwater storage volume of 37,800-50,400 af. Average annual recharge within the sewer service area is approximately 1,700 af/yr, for an average residence time of 22-30 years. This is approximately the length of time that the basin has been heavily developed, so one would expect observed nitrate concentrations in the shallow aquifer system to be approaching the average nitrate concentration in recharge, which is 10-20 mg/l as N, depending on land use category. Five of the eight wells for which long-term chemographs are available had concentrations in the 10-20 mg/l range during the past 10 years. Two had lower concentrations and one had higher concentrations. Half of the wells had increasing nitrate concentrations during that period. These results are consistent with a system that is nearing equilibrium with its input

concentrations. Thus, the shallow aquifer system appears to take on the order of three decades to equilibrate to a change in nitrate loading.

The deep aquifer system has a much longer time constant. The volume of water in the onshore part of the deep system is 452,000 af. The flow of water through the deep system is largely driven by pumping, which averaged 1,690 af/yr during 1998-2001. This corresponds to an average residence time of 268 years. This means that the deep system has completed only about 11% of its adjustment to the nitrate load from septic systems during the past 30 years. It also means that shallow groundwater with concentrations in the 10-20 mg/l range is presently moving toward the deep wells and will arrive before most of the groundwater recharged during the next 30 years arrives. Thus, one can deduce that nitrate concentrations in some deep wells will increase for possibly decades before they begin decreasing in response to the sewer project. Fortunately, because of dispersion, the maximum concentrations will be lower than the maximum concentration in the shallow aquifer system.

Additional Conclusions

Additional specific conclusions that can be drawn from this investigation are:

- The new recharge pre-processor provides more defensible estimates of recharge rates and nitrate loading rates.
- The model adequately simulates groundwater flow conditions assuming a quasi-steady-state condition existed between 2000 and 2002
- Simulated nitrate concentrations in model layer 1 closely parallel the distribution of nitrate concentrations in groundwater recharge.
- The simulated nitrate values are relatively sensitive to porosity for short time periods (10 years), but the final nitrate concentrations are more dependent on loading concentrations.
- The sewer project has a noticeable impact on future nitrate levels in the shallow aquifer.
- Even after the sewer project takes effect, nitrate concentrations will be only slightly below the MCL because background concentrations in this basin appear to be slightly elevated and because the nitrate concentration in the treated, percolated effluent is expected to be 7 mg/l (only slightly less than the MCL of 10 mg/l).
- Nitrate levels in some deep wells will continue to rise during the first 30 years following project construction as existing nitrate in shallow aquifers continues to be drawn into the deep aquifers. Whether nitrate increases or decreases at a particular well is sensitive to the distribution of pumping among all of the deep wells.
- Simulated nitrate concentrations in model layer 1 are not very sensitive to layer thickness.

Recommendations

- Change orientation of model grid so that the row direction aligns with the axis of the syncline that forms the groundwater basin.

Table 1. Recharge Zone Parameters

Parameter	Units or Category	Recharge Zone 1 Ocean & Morro Bay	2 Sandspit Shrubs	3 Sandspit Bare	4 Shorline Shrubs/Trees	5 Residential Med. Density	6 Undeveloped Grass/Shrub	7 Residential Low Density	8 Residential Low Density	9 Monarch Elementary	10 Undeveloped Trees	11 Sea Pines Golf Course
Area within basin (acres)		1,510	202	472	47	290	452	14	34	11	154	26
Annual precipitation (in.)		14.5	14.5	14.5	15	15	15	15	15	15	15	15
Runoff equation slope		n.a.	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.6
Runoff equation intercept (in)		n.a.	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.4	0.8
Available water capacity (in/in)		n.a.	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.17	0.06
Perched zone category		n.a.	0	0	0	0	0	0	0	0	0	0
Perching clay Kv (ft/d)		n.a.	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Max. perched storage (af)		n.a.	303	709	70	435	678	21	50	17	231	39
Initial perched storage (af)		n.a.	152	354	35	217	339	10	25	8	116	19
Initial perched nitrate (lb)		n.a.	741	1,732	171	1,062	1,658	50	123	41	565	95
FRACIMPLK		n.a.	1.00	1.00	1.00	0.70	1.00	0.90	0.90	0.70	1.00	1.00
N load - septic	No. of DUE	0	0	0	0	1,020	0	10	10	40	0	20
N load - horses	No. of horses	0	0	0	0	0	0	20	20	0	0	0
N load - dogs	No. of dogs	0	0	0	0	935	0	9	9	0	0	0
N load - cats	No. of cats	0	0	0	0	1,402	0	14	14	0	0	0
N load - WW perc	Volume (af/yr)	0	0	0	0	0	0	0	0	0	0	0
Septic leachate flow	Volume (af/mo)	0.00	0.00	0.00	0.00	18.01	0.00	0.18	0.18	0.71	0.00	0.35
Land cover (fraction of area)	Impervious	0.00	0.00	0.00	0.00	0.50	0.00	0.20	0.20	0.40	0.00	0.00
Land cover (fraction of area)	Trees	0.00	0.00	0.00	0.60	0.10	0.00	0.10	0.70	0.10	1.00	0.00
Land cover (fraction of area)	Brush	0.00	1.00	0.00	0.40	0.10	0.60	0.40	0.00	0.00	0.00	0.00
Land cover (fraction of area)	Bare	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land cover (fraction of area)	Ornamentals	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.10	0.00	0.00
Land cover (fraction of area)	Turf	0.00	0.00	0.00	0.00	0.20	0.00	0.10	0.10	0.40	0.00	1.00
Land cover (fraction of area)	Crop	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land cover (fraction of area)	Weed	0.00	0.00	0.00	0.00	0.00	0.40	0.20	0.00	0.00	0.00	0.00
Land cover (fraction of area)	Wetland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes:
Kv = vertical hydraulic conductivity, FRACIMPLK = fraction of impervious area that runs off to adjacent pervious soils,
DUE = dwelling unit equivalents, WW = wastewater
Perched zone category: 1 = within boundaries of perching clay, 2 = adjacent to perching clay and receives
shunted recharge from perched area, 3 = unaffected by perching clay

Table 1 -- Continued.

Parameter	Units or Category	Recharge Zone										
		12 Cabrillo Estates	13 Horse Ranch	14 Undeveloped Shrubs	16 Residential Med. Density	20 Residential Med. Density	21 Irrigated Crops	24 Nonirrigated Crops	25 Nonirrigated Pasture	26 Irrigated Pasture	27 Cemetery	28 Irrigated Crops
Area within basin (acres)		65	13	114	209	45	259	111	245	15	19	20
Annual precipitation (in.)		15.5	15.5	16	15	15.5	15.5	15.5	15.5	15.5	15.5	15
Runoff equation slope		0.6	0.6	0.6	0.6	0.8	0.8	0.9	0.9	0.9	0.9	0.6
Runoff equation intercept (in)		0.8	0.8	0.8	0.8	0.4	0.4	0.2	0.2	0.2	0.2	0.8
Available water capacity (in/in)		0.06	0.06	0.06	0.06	0.17	0.17	0.16	0.16	0.16	0.16	0.06
Perched zone category		0	0	0	0	0	0	0	0	0	0	0
Perching clay Kv (ft/d)		0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Max. perched storage (af)		98	19	171	313	67	389	166	367	22	29	30
Initial perched storage (af)		49	10	85	157	34	194	83	184	11	14	15
Initial perched nitrate (lb)		239	47	417	765	164	950	406	897	55	70	73
FRACIMPLK		0.60	1.00	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00
N load - septic	No. of DUE	200	10	0	881	80	0	10	10	0	0	0
N load - horses	No. of horses	0	40	0	0	0	0	10	10	0	0	0
N load - dogs	No. of dogs	183	0	0	807	73	0	9	9	0	0	0
N load - cats	No. of cats	275	0	0	1,211	110	0	14	14	0	0	0
N load - WW perc	Volume (af/yr)	0	0	0	0	0	0	0	0	0	0	0
Septic leachate flow	Volume (af/mo)	3.53	0.18	0.00	15.55	1.41	0.00	0.18	0.18	0.00	0.00	0.00
Land cover (fraction of area)	Impervious	0.30	0.20	0.00	0.50	0.20	0.00	0.10	0.10	0.00	0.10	0.00
Land cover (fraction of area)	Trees	0.10	0.00	0.00	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00
Land cover (fraction of area)	Brush	0.30	0.10	0.90	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00
Land cover (fraction of area)	Bare	0.00	0.10	0.00	0.00	0.10	0.20	0.20	0.20	0.10	0.10	0.00
Land cover (fraction of area)	Ornamentals	0.10	0.00	0.00	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00
Land cover (fraction of area)	Turf	0.10	0.40	0.00	0.20	0.20	0.00	0.00	0.00	0.90	0.70	0.00
Land cover (fraction of area)	Crop	0.00	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.90
Land cover (fraction of area)	Weed	0.10	0.20	0.10	0.10	0.20	0.00	0.70	0.70	0.00	0.10	0.00
Land cover (fraction of area)	Wetland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 1 -- Continued.

Parameter	Units or Category	Recharge Zone										
		105 Residential Med. Density	106 Undeveloped Grass/Shrub	107 Residential Low Density	109 High School	110 Uindeveloped Marsh/Trees	114 Undeveloped Shrubs	115 Commercial	116 Residential Med. Density	117 Bayview Heights	118 Mobile Homes	119 Undeveloped Trees
Area within basin (acres)		12	192	274	8	10	10	176	319	166	45	121
Annual precipitation (in.)		15	15	15.25	15	15	16	15.25	15	16	16	16
Runoff equation slope		0.9	0.9	0.9	0.9	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Runoff equation intercept (in)		0.2	0.2	0.2	0.2	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Available water capacity (in/in)		0.16	0.16	0.16	0.16	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Perched zone category		1	1	1	1	1	1	1	1	1	1	1
Perching clay Kv (ft/d)		0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Max. perched storage (af)		18	288	411	12	15	14	264	478	248	67	181
Initial perched storage (af)		9	144	205	6	7	7	132	239	124	34	90
Initial perched nitrate (lb)		44	703	1,003	30	36	35	644	1,169	607	164	442
FRACIMPLK		0.70	1.00	0.90	0.80	1.00	1.00	0.30	0.70	0.70	0.20	1.00
N load - septic	No. of DUE	36	0	130	40	0	0	980	1,285	314	200	0
N load - horses	No. of horses	0	0	80	0	0	0	0	0	0	0	0
N load - dogs	No. of dogs	33	0	119	0	0	0	0	1,177	288	183	0
N load - cats	No. of cats	49	0	179	0	0	0	0	1,766	432	275	0
N load - WW perc	Volume (af/yr)	0	0	0	0	0	0	0	0	0	0	0
Septic leachate flow	Volume (af/mo)	0.64	0.00	2.30	0.71	0.00	0.00	17.30	22.69	5.54	3.53	0.00
Land cover (fraction of area)	Impervious	0.50	0.00	0.20	0.30	0.00	0.00	0.60	0.50	0.40	0.80	0.00
Land cover (fraction of area)	Trees	0.10	0.00	0.10	0.00	1.00	0.00	0.00	0.10	0.10	0.00	0.80
Land cover (fraction of area)	Brush	0.10	0.60	0.10	0.10	0.00	0.90	0.00	0.00	0.20	0.00	0.20
Land cover (fraction of area)	Bare	0.00	0.00	0.10	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00
Land cover (fraction of area)	Ornamentals	0.10	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.00
Land cover (fraction of area)	Turf	0.20	0.00	0.20	0.50	0.00	0.00	0.10	0.20	0.20	0.10	0.00
Land cover (fraction of area)	Crop	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land cover (fraction of area)	Weed	0.00	0.40	0.30	0.10	0.00	0.10	0.10	0.10	0.00	0.00	0.00
Land cover (fraction of area)	Wetland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 1 -- Continued.

Parameter	Units or Category	Recharge Zone										
		128 Irrigated Crops	205 Residential Med. Density	206 Undeveloped Grass/Shrub	209 High School	210 UindevelopedMarsh/Trees	214 Undeveloped Shrubs	216 Residential Med. Density	220 Residential Low-Density	221 Irrigated Crops	228 Irrigated Crops	229 Horse Ranch
Area within basin (acres)		5	44	210	22	18	18	110	23	53	7	3
Annual precipitation (in.)		15.25	15.5	16	15	15	16	15	15.5	16	15.25	16
Runoff equation slope		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.6	0.8
Runoff equation intercept (in)		0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.4	0.4	0.8	0.4
Available water capacity (in/in)		0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.17	0.17	0.06	0.17
Perched zone category		1	2	2	2	2	2	2	2	2	2	2
Perching clay Kv (ft/d)		0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Max. perched storage (af)		7	66	315	32	27	26	165	34	80	10	4
Initial perched storage (af)		4	33	158	16	14	13	83	17	40	5	2
Initial perched nitrate (lb)		18	162	771	79	66	64	403	83	195	24	9
FRACIMPLK		1.00	1.00	1.00	0.80	1.00	1.00	1.00	0.90	1.00	1.00	1.00
N load - septic	No. of DUE	0	132	0	60	0	0	464	40	0	0	5
N load - horses	No. of horses	0	0	0	0	0	0	0	0	0	0	40
N load - dogs	No. of dogs	0	121	0	0	0	0	425	37	0	0	0
N load - cats	No. of cats	0	181	0	0	0	0	638	55	0	0	0
N load - WW perc	Volume (af/yr)	0	0	0	0	0	0	0	0	0	0	0
Septic leachate flow	Volume (af/mo)	0.00	2.33	0.00	1.06	0.00	0.00	8.19	0.71	0.00	0.00	0.09
Land cover (fraction of area)	Impervious	0.00	0.50	0.00	0.30	0.00	0.00	0.50	0.20	0.00	0.00	0.10
Land cover (fraction of area)	Trees	0.00	0.10	0.00	0.00	1.00	0.00	0.10	0.10	0.00	0.00	0.00
Land cover (fraction of area)	Brush	0.00	0.10	0.60	0.10	0.00	0.90	0.00	0.10	0.00	0.00	0.00
Land cover (fraction of area)	Bare	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.00	0.10
Land cover (fraction of area)	Ornamentals	0.00	0.10	0.00	0.00	0.00	0.00	0.10	0.10	0.00	0.00	0.00
Land cover (fraction of area)	Turf	0.00	0.20	0.00	0.50	0.00	0.00	0.20	0.20	0.00	0.00	0.70
Land cover (fraction of area)	Crop	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.90	0.00
Land cover (fraction of area)	Weed	0.00	0.00	0.40	0.10	0.00	0.10	0.10	0.20	0.00	0.00	0.10
Land cover (fraction of area)	Wetland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 4. Simulated Average Annual Recharge and Nitrogen Loads under Existing Conditions with 2000-2002 Hydrology

Table 4

Zone Number	Land Use	Zone Area (acres)	Rainfall (ac-ft/yr)	Runoff (ac-ft/yr)	Evapo-transpir-ation (ET) (ac-ft/yr)	Irrigation (ac-ft/yr)	Residual Potential ET (ac-ft/yr)	Septic System Leachate (ac-ft/yr)	Groundwater Recharge: Before Perching Effects (ac-ft/yr)	Groundwater Recharge: After Perching Effects (ac-ft/yr)	Groundwater Recharge: After Perching Effects (in/yr)	Nitrogen Before Perching Effects: Load (lb/yr)	Nitrogen Before Perching Effects: Concentration (lb/ac-ft)	Nitrogen Before Perching Effects: Concentration (mg/l)	Nitrogen After Perching Effects: Load (lb/yr)	Nitrogen After Perching Effects: Concentration (lb/ac-ft)	Nitrogen After Perching Effects: Concentration (mg/l)
2	Sandspit Shrubs	202	274	22	165	0	0	0	64	64	3.8	1,008	15.9	5.8	1,007	15.9	5.8
3	Sandspit Bare	472	639	51	139	0	0	0	443	443	11.3	2,364	5.3	2.0	2,363	5.3	2.0
4	Shoreline Shrubs/Trees	47	66	6	41	0	61	0	13	13	3.3	228	17.5	6.4	229	17.5	6.4
5	Residential Med. Density	290	406	220	246	182	63	216	471	471	19.5	13,620	28.9	10.6	13,622	28.9	10.6
6	Undeveloped Grass/Shrub	452	633	53	342	0	0	0	198	198	5.2	5,160	26.1	9.6	5,159	26.1	9.6
7	Residential Low Density	14	19	5	11	4	3	2	11	11	9.4	708	65.8	24.2	706	65.8	24.2
8	Residential Low Density	34	47	13	30	9	51	2	20	20	7.0	816	41.8	15.4	815	41.8	15.4
9	Monarch Elementary	11	16	7	14	13	2	8	20	20	21.1	576	29.3	10.8	578	29.3	10.8
10	Undeveloped Trees	154	216	42	161	0	313	0	0	0	0.0	768	undefined	undefined	undefined	undefined	undefined
11	Sea Pines Golf Course	26	36	3	67	67	0	5	37	37	17.3	1,032	27.7	10.2	1,032	27.7	10.2
12	Cabrillo Estates	65	94	34	54	24	14	42	86	86	15.8	2,700	31.5	11.6	2,701	31.5	11.6
13	Horse Ranch	13	19	5	16	13	0	2	16	16	14.5	1,260	81.1	29.8	1,257	81.1	29.8
14	Undeveloped Shrubs	114	170	16	94	0	0	0	48	48	5.0	756	15.8	5.8	757	15.8	5.8
16	Residential Med. Density	209	292	158	174	131	45	187	404	404	23.2	11,592	28.7	10.5	11,592	28.7	10.5
20	Residential Med. Density	45	65	24	40	14	9	17	39	39	10.4	1,476	38.0	14.0	1,473	38.0	14.0
21	Irrigated Crops	259	375	76	277	191	0	0	200	200	9.3	7,020	35.1	12.9	7,024	35.1	12.9
24	Nonirrigated Crops	111	160	70	66	0	0	2	34	34	3.7	2,124	62.6	23.0	2,124	62.6	23.0
25	Nonirrigated Pasture	245	354	155	146	0	0	2	72	72	3.5	4,296	59.4	21.8	4,298	59.4	21.8
26	Irrigated Pasture	15	22	8	24	18	0	0	7	7	5.3	444	66.9	24.6	437	66.9	24.6
27	Cemetery	19	28	12	25	18	0	0	9	9	5.9	492	52.5	19.3	490	52.5	19.3
28	Irrigated Crops	20	28	2	31	29	0	0	24	24	14.5	600	24.8	9.1	599	24.8	9.1
105	Residential Med. Density	12	17	11	8	4	3	7	15	4	4.4	504	34.4	12.7	156	35.7	13.1
106	Undeveloped Grass/Shrub	192	268	98	150	0	0	0	6	6	0.4	2,184	undefined	undefined	1,944	331.4	121.9
107	Residential Low Density	274	389	193	212	73	61	28	133	94	4.1	7,332	55.2	20.3	5,885	62.9	23.1
109	High School	8	12	6	9	6	0	8	13	3	4.4	552	42.8	15.7	134	44.0	16.2
110	Uindeveloped Marsh/Trees	10	14	1	9	0	21	0	2	1	1.7	48	20.9	7.7	28	20.2	7.4
114	Undeveloped Shrubs	10	14	1	8	0	0	0	4	2	3.0	60	14.9	5.5	50	20.4	7.5
115	Commercial	176	250	159	90	65	0	208	317	64	4.4	11,268	35.6	13.1	2,351	36.6	13.5
116	Residential Med. Density	319	446	242	265	200	69	272	560	116	4.4	17,112	30.6	11.2	3,759	32.3	11.9
117	Bayview Heights	166	247	113	155	104	35	66	212	61	4.4	5,124	24.2	8.9	1,610	26.6	9.8
118	Mobile Homes	45	67	55	19	17	0	42	63	16	4.4	2,400	38.3	14.1	643	39.3	14.4
119	Undeveloped Trees	121	180	17	112	0	205	0	36	20	2.0	600	16.7	6.1	579	28.8	10.6
128	Irrigated Crops	5	7	1	8	7	0	0	6	2	4.3	144	23.6	8.7	51	28.4	10.4
205	Residential Med. Density	44	64	35	38	28	9	28	75	112	30.4	1,848	24.8	9.1	3,039	27.2	10.0
206	Undeveloped Grass/Shrub	210	314	29	163	0	0	0	103	280	16.0	2,400	23.2	8.5	8,098	28.9	10.6
209	High School	22	30	11	31	28	0	13	35	53	29.4	1,008	29.0	10.7	1,597	30.1	11.1
210	Uindeveloped Marsh/Trees	18	25	2	17	0	39	0	4	19	13.0	96	22.5	8.3	579	29.8	11.0
214	Undeveloped Shrubs	18	26	2	15	0	0	0	7	22	15.1	120	16.2	6.0	593	26.7	9.8
216	Residential Med. Density	110	154	84	91	69	24	98	198	290	31.6	6,108	30.9	11.4	9,091	31.3	11.5
220	Residential Low-Density	23	33	12	20	7	5	8	20	38	20.4	744	38.2	14.0	1,109	28.8	10.6
221	Irrigated Crops	53	79	17	56	39	0	0	43	88	19.8	1,440	33.6	12.4	3,082	35.2	12.9
228	Irrigated Crops	7	9	1	10	10	0	0	8	13	24.9	192	23.7	8.7	371	27.6	10.1
229	Horse Ranch	3	4	1	3	2	0	1	3	5	23.5	1,032	344.0	126.5	1,109	226.4	83.2
	Total	4,658	6,606	2,073	3,652	1,368	1,031	1,267	4,075	3,525	n.a.	121,356	n.a.	n.a.	104,122	n.a.	n.a.
	Average										9.1		29.8	10.9		29.5	10.9

Notes:
1) In zones where simulated recharge is zero, N concentration is undefined. 2) n.a. = not applicable

Table 9. Simulated Average Annual Recharge and Nitrogen Loads with Proposed Sewer Project and 2000-2002 Hydrology

Table 9

Zone Number	Land Use	Zone Area (acres)	Rainfall (ac-ft/yr)	Runoff (ac-ft/yr)	Evapo-transpir-ation (ET) (ac-ft/yr)	Irrigation (ac-ft/yr)	Residual Potential ET (ac-ft/yr)	Septic System Leachate (ac-ft/yr)	WWTP Perco-lation (ac-ft/yr)	Groundwater Recharge: Before Perching Effects (ac-ft/yr)	Groundwater Recharge: After Perching Effects (ac-ft/yr)	Groundwater Recharge: After Perching Effects (in/yr)	Nitrogen Before Perching Effects: Load (lb/yr)	Nitrogen Before Perching Effects: Concentration (lb/ac-ft)	Nitrogen Before Perching Effects: Concentration (mg/l)	Nitrogen After Perching Effects: Load (lb/yr)	Nitrogen After Perching Effects: Concentration (lb/ac-ft)	Nitrogen After Perching Effects: Concentration (mg/l)
2	Sandspit Shrubs	202	274	22	165	0	0	0	0	64	64	3.8	1,008	15.9	5.8	1,007	15.9	5.8
3	Sandspit Bare	472	639	51	139	0	0	0	0	443	443	11.3	2,364	5.3	2.0	2,363	5.3	2.0
4	Shoreline Shrubs/Trees	47	66	6	41	0	61	0	0	13	13	3.3	228	17.5	6.4	229	17.5	6.4
5	Residential Med. Density	288	403	219	245	181	62	0	0	253	253	10.5	3,876	15.3	5.6	3,875	15.3	5.6
6	Undeveloped Grass/Shrub	441	617	52	334	0	0	0	0	193	193	5.2	5,028	26.1	9.6	5,027	26.1	9.6
7	Residential Low Density	12	17	5	10	3	2	0	0	8	8	7.5	600	75.9	27.9	585	75.9	27.9
8	Residential Low Density	34	47	13	30	9	51	0	0	17	17	6.2	732	42.1	15.5	732	42.1	15.5
9	Monarch Elementary	10	14	6	13	11	2	0	0	10	10	12.0	168	17.0	6.2	167	17.0	6.2
10	Undeveloped Trees	154	216	42	161	0	313	0	0	0	0	0.0	768	undefined	undefined	undefined	undefined	undefined
11	Sea Pines Golf Course	26	36	3	67	67	0	0	0	33	33	15.3	840	25.4	9.3	841	25.4	9.3
12	Cabrillo Estates	65	94	34	54	24	14	42	0	86	86	15.8	2,700	31.5	11.6	2,701	31.5	11.6
13	Horse Ranch	13	19	5	16	13	0	2	0	16	16	14.5	1,260	81.1	29.8	1,257	81.1	29.8
14	Undeveloped Shrubs	114	170	16	94	0	0	0	0	48	48	5.0	756	15.8	5.8	757	15.8	5.8
16	Residential Med. Density	209	292	158	174	131	45	0	0	218	218	12.5	3,192	14.7	5.4	3,191	14.7	5.4
20	Residential Med. Density	45	65	24	40	14	9	17	0	39	39	10.4	1,476	38.0	14.0	1,473	38.0	14.0
21	Irrigated Crops	259	375	76	277	191	0	0	0	200	200	9.3	7,020	35.1	12.9	7,024	35.1	12.9
24	Nonirrigated Crops	111	160	70	66	0	0	2	0	34	34	3.7	2,124	62.6	23.0	2,124	62.6	23.0
25	Nonirrigated Pasture	245	354	155	146	0	0	2	0	72	72	3.5	4,296	59.4	21.8	4,298	59.4	21.8
26	Irrigated Pasture	15	22	8	24	18	0	0	0	7	7	5.3	444	66.9	24.6	437	66.9	24.6
27	Cemetery	19	28	12	25	18	0	0	0	9	9	5.9	492	52.5	19.3	490	52.5	19.3
28	Irrigated Crops	20	28	2	31	29	0	0	0	24	24	14.5	600	24.8	9.1	599	24.8	9.1
105	Residential Med. Density	12	17	11	8	4	3	0	0	7	4	4.2	156	21.7	8.0	93	22.5	8.3
106	Undeveloped Grass/Shrub	190	266	98	149	0	0	0	0	6	6	0.4	2,172	undefined	undefined	1,933	331.4	121.9
107	Residential Low Density	274	389	193	212	73	61	0	0	105	79	3.4	6,096	57.8	21.3	4,983	63.4	23.3
109	High School	8	12	6	9	6	0	8	0	13	3	4.4	552	42.8	15.7	130	43.0	15.8
110	Uindeveloped Marsh/Trees	10	14	1	9	0	21	0	0	2	1	1.7	48	20.9	7.7	28	20.2	7.4
114	Undeveloped Shrubs	10	14	1	8	0	0	0	0	4	2	3.0	60	14.9	5.5	49	20.1	7.4
115	Commercial	176	250	159	90	65	0	0	0	109	61	4.2	1,920	17.6	6.5	1,379	22.5	8.3
116	Residential Med. Density	309	432	234	257	194	67	0	0	279	113	4.4	4,716	16.9	6.2	2,142	19.0	7.0
117	Bayview Heights	166	247	113	155	104	35	0	0	145	61	4.4	2,124	14.6	5.4	1,059	17.5	6.4
118	Mobile Homes	45	67	55	19	17	0	0	0	20	14	3.9	492	24.0	8.8	351	24.4	9.0
119	Undeveloped Trees	121	180	17	112	0	205	0	0	36	20	2.0	600	16.7	6.1	579	28.8	10.6
128	Irrigated Crops	5	7	1	8	7	0	0	0	6	2	4.3	144	23.6	8.7	51	28.4	10.4
205	Residential Med. Density	44	64	35	38	28	9	0	0	47	79	21.4	588	12.6	4.6	1,068	13.6	5.0
206	Undeveloped Grass/Shrub	209	312	29	162	0	0	0	0	103	254	14.6	2,376	23.1	8.5	5,096	20.0	7.4
209	High School	22	30	11	31	28	0	13	0	35	50	28.0	1,008	29.0	10.7	1,268	25.1	9.2
210	Uindeveloped Marsh/Trees	18	25	2	17	0	39	0	0	4	17	11.6	96	22.5	8.3	325	18.7	6.9
214	Undeveloped Shrubs	18	26	2	15	0	0	0	0	7	20	13.7	120	16.2	6.0	345	17.1	6.3
216	Residential Med. Density	110	154	84	91	69	24	0	0	99	179	19.5	1,680	16.9	6.2	2,607	14.5	5.3
220	Residential Low-Density	23	33	12	20	7	5	8	0	20	36	19.0	744	38.2	14.0	1,223	34.1	12.5
221	Irrigated Crops	53	79	17	56	39	0	0	0	43	81	18.4	1,440	33.6	12.4	2,131	26.2	9.6
228	Irrigated Crops	7	9	1	10	10	0	0	0	8	13	23.4	192	23.7	8.7	133	10.5	3.9
229	Horse Ranch	3	4	1	3	2	0	1	0	3	5	22.1	1,032	344.0	126.5	1,062	230.8	84.9
301	WW Perc. Broderson	12	16	1	9	0	0	0	908	913	913	952.7	17,388	19.0	7.0	17,380	19.0	7.0
302	WW Perc. Monarch Grove	1	2	1	2	2	0	0	78	80	80	684.9	1,512	18.9	6.9	1,517	19.0	7.0
303	WW Perc. LOVR-Pine	1	2	1	1	0	0	0	56	57	57	487.7	1,080	18.9	7.0	1,542	27.1	10.0
304	WW Perc. Pismo	6	8	4	5	4	1	0	179	184	2	4.4	3,492	18.9	7.0	40	18.9	7.0
305	WW Perc. Santa Maria	4	6	3	4	3	1	0	179	183	2	4.4	3,468	18.9	7.0	30	18.9	7.0
306	WW Perc. El Moro	1	2	0	1	0	0	0	56	57	58	495.1	1,080	19.0	7.0	1,100	19.0	7.0
307	WW Perc. South Bay	1	2	1	1	0	0	0	90	90	1	4.6	1,716	19.1	7.0	10	19.2	7.0
308	WW Perc. Vista de Oro	1	2	1	1	1	0	0	23	24	24	202.6	444	18.7	6.9	443	18.7	6.9
	Total	4,658	6,606	2,073	3,652	1,368	1,030	97	1,570	4,477	4,022	n.a.	98,508	n.a.	n.a.	89,275	n.a.	n.a.
	Average											10.4		22.0	8.1		22.2	8.2

Notes:
1) In zones where simulated recharge is zero, N concentration is undefined. 2) n.a. = not applicable

Table 10. Comparison of Basinwide Nitrogen Loads with and without Proposed Sewer Project

Load Source	Existing Mass (lb)	Existing Concen-tation (mg/l)	Buildout Mass (lb)	Buildout Concen-tation (mg/l)
Septic systems	57,021	16.6	4,341	16.4
Treated effluent percolation	0	n.a.	29,830	7.0
Animals				
Horses	5,082	n.a.	5,082	n.a.
Dogs	1,016	n.a.	1,016	n.a.
Cats	785	n.a.	785	n.a.
Cropland	16,260	15.2	16,260	15.2
Natural areas	15,576	6.3	15,576	6.3
Developed areas (excluding septic leachate and animals)	25,616	6.3	25,617	6.3
Total	121,356	n.a.	98,508	n.a.
Average	n.a.	11.0	n.a.	8.1

Notes:

n.a. = not applicable, such as N loads not associated with a specific recharge flow

All values represent recharge flows and nitrogen mass before the effects of the perching layer.

Cropland includes irrigated and nonirrigated fields and pasture

Developed areas include various percentages of impervious surfaces, natural vegetation, weeds, and irrigated landscaping.

HYDROFOCUS INC.
Solutions for Land and Water Resources

3 August 2010

Mr. Keith Wimer
Los Osos Sustainability Group
1101 14th Street
Los Osos, CA 93402

SUBJECT: Review of Los Osos Basin Update and Current Wastewater Project Description--Revised

After reviewing San Luis Obispo County's update on groundwater conditions in the Los Osos basin and the current description of the wastewater project, I would like to offer the following observations.

- **The seawater intrusion problem is extremely urgent.** Seawater intrusion moved over a half mile in four years and has reached the center of municipal pumping from the lower aquifer. As I stated in my previous review (February 4) seawater intrusion is very difficult to reverse and renders water unusable for drinking when it exceeds only 1.5% of the inflow to a well. The most recent intrusion data indicate seawater intrusion is accelerating and threatens to shut down (or is already shutting down) the community's largest production wells.

- **Two immediate actions are needed to protect the water supply and prevent further intrusion.** Both actions can be implemented quickly (1-2 years), and both actions are mutually compatible:

    - **Shift most of the municipal pumping up from the lower to the upper aquifer system, and/or shift some of the municipal pumping farther inland.** This requires drilling new wells and laying more pipeline.
        - This action may not be sufficient to provide long-term protection against seawater intrusion because the basin has never experienced that much upper-zone pumping, particularly in the absence of septic system recharge.

    - **Decrease average per-capita water residential use from 104 gallons per capita per day (gpcd) to 74 gpcd or lower.** This latter level is reasonable since it is the current average for the City of San Luis Obispo.
        - This action provides more reliable long-term protection against seawater intrusion because it addresses the fundamental problem which is an overall imbalance in the water budget (i.e., more water is consumed in the basin than is being replenished). This would reduce total water production in the basin by about 500 AFY, which provides a reasonable

margin of safety given the uncertainty in previous studies (simulated intrusion rates) and uncertainties in the effects of currently proposed projects (shifting large amounts of pumping from the lower to upper aquifer; the percolation capacity of the Broderson leach fields).

- **Seawater intrusion and nitrates must be managed with an integrated basin-wide plan—they are interconnected problems within a single hydrologic system.** Examples of the interconnectedness between issues include:

    - Sewering will greatly decrease recharge to the upper aquifer at the same time municipal pumping from the upper aquifer will be increasing to minimize seawater intrusion. These two major changes are a huge shift in the upper aquifer water balance and could cause seawater intrusion in that aquifer.
    - Indoor water conservation tends to increase the salinity of wastewater (same quantity of salts will be dissolved into a smaller volume of water). Conservation is urgently needed, but its effect on recycled water salinity needs to be considered when planning for irrigation reuse. The Fine Screening Analysis estimates domestic water use adds 200 mg/l of total dissolved solids (TDS) from salts to the wastewater stream.
    - A small amount of saltwater intrusion can also increase the salinity of the municipal water supply to the point that resulting reclaimed wastewater will be unacceptable for irrigation reuse. A small amount of intrusion could easily push the TDS concentration of the municipal supply to near the short-term drinking water MCL of 1,000 mg/L, if intrusion outpaces the upward shift in pumping. Adding 200 mg/L of TDS from normal urban use would result in a wastewater TDS approaching 1,200 mg/L. The reuse technical memorandum (Carollo Engineers 2008) indicated that this level of salts could decrease yields of lettuce and peppers to less than 90% of normal yields, although other crops would remain above 90%. Nevertheless, this constraint on crop selection could diminish the appeal of recycled water to local growers
    - Outdoor conservation measures, especially xeriscape, can also have a beneficial effect on the amount of nitrates and other contaminants entering the groundwater. As water tables drop, nitrates are treated to a greater extent in the vadose (dry) zone of the soil, and use of native plants with xeriscape requires fewer fertilizers reducing nitrates entering the soil.
    - Stormwater recharge, along with conservation, benefit the water balance equation. Stormwater recharge will also control flooding in problem locations, reduce pollution of surface water, and dilute contaminants in the groundwater by promoting more efficient percolation of clean stormwater (infiltrated before it picks up pollutants).

- **The conservation target of 160 AFY in the project description is too small. Greater conservation is feasible and needed.**

    - The conservation element focuses only on residential indoor water use within the prohibition zone. This scope is unnecessarily narrow. Expanding to a larger footprint (the Urban Reserve Line) and to all types of water use (residential outdoor and commercial) greatly increases the conservation potential, as the following bullets demonstrate.
    - Current per-capita water use within the Urban Reserve Line is about 104 gpcd (1,722 AFY residential water use/14,800 residents, per LOSG data sheets).
    - Residential water use in San Luis Obispo is 74 gpcd. If Los Osos decreases its water use to the same level, the annual savings would be 497 AFY. This exceeds the proposed percolation rate at the Broderson leach fields, and it does not include potential reductions in commercial and institutional use.
    - The recent County update on the project commits to a target of 50 gpcd for residential indoor use within the prohibition zone (12, 450 population). This goal is less effective than meeting the San Luis Obispo target. If indoor residential use in this zone is 66 gpcd (per the Fine Screening Analysis), then a decrease to 50 gpcd would save only 223 AFY. If the 74 gpcd target were used in the prohibition zone, 418 gpcd would be saved. The target for overall use (74 gpcd) is preferable (especially if used within the URL) to the target for indoor use (50 gpcd) because it encompasses a broader range of conservation opportunities.
    - Conservation has many co–benefits, such as reduced energy consumption for pumping and heating water for domestic and commercial uses. Conservation is doubly important in conjunction with the wastewater project, because it decreases the amount of water that is exported from the western half of the basin in the first place, thereby decreasing the volume of recycled water that needs to be piped back to the west side. This decreases energy and operating costs for water treatment, wastewater treatment, and conveyance in both directions.
    - Conservation measures that decrease indoor water use or reuse water on-site have the dual benefit of decreasing municipal pumping and decreasing wastewater generation. These measures include low-flow plumbing fixtures and graywater systems. The previous, onerous regulations governing residential graywater systems were largely eliminated in the 2010 update to the California Plumbing Code. Graywater systems are now much more feasible from a permitting and cost standpoint.
    - Other conservation and water management measures have no effect on wastewater generation but are needed to bring the water budget in the Western Compartment back into balance. Some of these are mentioned in the Basin Update and previous project design studies but are not included in the current project description. Measures in this category include agricultural exchange

(using irrigation wells in the Los Osos Creek area for municipal supply in exchange for recycled water delivered for crop irrigation), stormwater management to increase percolation of runoff, and rainwater harvesting. These should all be included as part of a comprehensive program to address wastewater management and seawater intrusion.

- **Previous studies should be updated to reflect the current project description and current status of seawater intrusion.**
  The current project description reportedly does not include sprayfields. The recently documented arrival of seawater intrusion at the center of pumping in the lower aquifer will undoubtedly alter pumping patterns. Some of the cost and feasibility analyses in previous studies (for example, the Fine Screening Analysis and reuse technical memorandum) should be updated to reflect current conditions and opportunities.
  - The arrival of seawater intrusion at the center of pumping in the lower aquifer will force purveyors to shift a large percentage of municipal pumping from the lower aquifer to the upper aquifer. This would move the seawater intrusion problem from the lower aquifer to the upper aquifer. It also means that the "mitigation factors" used to evaluate the effect of wastewater alternatives on lower aquifer intrusion are not as relevant. The water balance and intrusion risk in the upper aquifer will be as important as in the lower aquifer, if not more so. For example, the effectiveness of percolation from the Broderson leach fields for mitigating upper aquifer intrusion is greater than for the lower aquifer, but new problems arise because the localized nature of Broderson recharge and increased upper aquifer pumping could result in seawater intrusion. As I mentioned in the previous review, Broderson recharge will not supply water to bay fringe marshes in the Baywood Park area.
  - The Fine Screening Analysis, the reuse technical memorandum (Carollo Engineers, 2008) and the Basin Update all assumed that water conservation would decrease water use and wastewater generation by only 160 AFY. The current project description assumes a 16 gpcd decrease in indoor water use (from 66 to 50 gpcd), which would decrease wastewater generation by 223 AFY for the initial population in the sewer service area (12,450 people) and by 330 AFY at buildout (18,428 people).
  - The previous studies rejected water conservation, urban reuse, graywater systems, low impact development (LID) and stormwater percolation as elements of the project because they would require purveyor participation. I disagree. All of those measures can be implemented by dealing directly with homeowners and public works agencies, bypassing the purveyors.
  - The current project description includes urban reuse, in spite of the previous conclusion that they would be infeasible because they require purveyor participation.

- The current, rapid advance of the intrusion front could change purveyor willingness to participate in conservation measures and alternative supply options such as agricultural exchange.
- Collectively, these several changes in basic project parameters (increased conservation, shifting pumping from the lower to upper aquifer, elimination of sprayfields) warrant an updated evaluation of project design and operation with an eye toward minimizing overall costs and impacts.

- **Eliminating the Broderson recharge facility appears feasible and should be considered.**
  The current project description proposes to percolate 448 AFY at the Broderson leach fields to meet two objectives: preventing seawater intrusion and disposing of wastewater in winter. A decrease in municipal pumping of 448 AFY would be at least as effective for preventing intrusion and is achievable through water conservation, agricultural exchange and urban reuse (see above discussion). Winter wastewater handling could be achieved through additional seasonal storage. In the absence of sprayfields and the Broderson facility winter storage for 4 months of recycled water is needed in an average year, and 5 months in a wet year. Also, approximately 28 inches of additional reservoir depth is needed to store excess rainfall during an exceptionally wet winter. With an initial wastewater generation rate of 700 AFY and 83 AFY of inflow and infiltration during the wet season, then 5 months of seasonal storage would require reservoir capacity totaling 375 AF. The reuse technical memorandum indicated that reservoirs with a depth of 15 feet "should be possible in any location east of Los Osos Creek" (Carollo Engineers, 2008). On a gross area basis, this translated to 12 AF of storage per acre of reservoir. Because approximately 2 feet of reservoir depth must be reserved for storing rain that falls directly on the reservoir during an exceptionally wet year, recycled water storage would be approximately 10 AF per acre of reservoir. The Giacomazzi site has at least 12 acres available for a reservoir. The remaining 255 AF of storage (requiring about 26 acres) would need to be constructed off-site, possibly on property owned by the end users.

  The cost of the additional reservoir capacity would be substantially offset by eliminating the cost of the Broderson leach fields and possibly eliminating nitrate removal from the treatment process. Nitrate removal is necessary for recharge but not for irrigation. The storage facility (ies) would be on land not suitable for farming and without sensitive habitat, avoiding impacts to both. Since project construction will take several years, time is available to locate and plan these sites as reuse contracts are being developed.

  This alternative would recycle as much as 100% of the wastewater for irrigation (783 AFY, including winter inflow and infiltration). Current irrigation in the Los Osos Creek area is approximately 800 AFY (Cleath-Harris Geologists, Inc., 2008), and urban reuse

opportunities totaling 133 AFY have been identified (Carollo Engineers, 2008). Thus, sufficient demand already exists to absorb the annual recycled water supply.

- **Wellhead treatment to meet primary drinking water standards is inevitable.** Seawater intrusion is forcing municipal production into the upper aquifer, where nitrate concentrations exceed the maximum contaminant level for drinking water in some locations. Wellhead treatment to remove nitrates using exchange resins is an approved technology, and is less costly and energy intensive than using reverse osmosis to desalinate seawater. Well-head treatment has been approved by the CPUC for Golden State Water Company in Los Osos.

- **The discrepancy between measured and simulated rates of seawater intrusion is not surprising.** The measured rate of advance of the saltwater/freshwater interface has been much greater than the simulated rate. The discrepancy likely stems from aquifer heterogeneity (water moves through the aquifer along preferred flow paths within sand lenses) that is not represented at the scale of the model. Heterogeneity does not have much effect on simulated water levels and basin yield, but it has a large effect on simulating the advance of the saltwater front.

- **If onshore water levels are above sea level, there will probably be no intrusion.** The rapid rate of seawater intrusion is caused by unsustainably low onshore groundwater levels. Although the greater density of seawater can theoretically cause intrusion even while onshore water levels are above sea level, I am unaware of a single instance when this occurred. In every case, seawater intrusion has occurred when onshore water levels fell below sea level. Water levels in the pumping trough in the center of Los Osos have been 5-10 feet below sea level for years Seawater will tend to move into this trough until water levels are brought up, which is why pumping must be reduced drastically in the lower aquifers (by approximately 1000 AFY according to model simulations[Cleath-Harris Geologists, 2009]) as soon as possible. Reduced pumping from conservation provides a rapid and direct way to address this issue, with long-term benefits.

- **Use monitoring data to track the saltwater interface and the model to track the water balance.** Models have trouble simultaneously simulating both detailed constituent transport and volumetric water budget components due to numerical instability. A transient groundwater flow model with monthly or shorter time steps will provide reasonable estimates of the water balance, particularly recharge and discharge along Los Osos Creek. The flows from that model can be inserted into the steady-state SEAWAT model to estimate the long-term interface location. Margins of safety should be applied to all modeling results to account for the uncertainties in modeling (see my January 13 comment memorandum) and the difficulty of reversing seawater intrusion.

Given the rapid advance of the saltwater front, additional monitoring wells are probably warranted to monitor the status of intrusion and the effect of pumping reductions on the rate of intrusion.

- **In summary, the wastewater project must be designed to help solve the seawater intrusion problem as part of an integrated water management plan for the Los Osos basin.** Water conservation and wastewater recycling are the key links between the wastewater project and seawater intrusion, and the present level of commitment to those project components is inadequate. The project should include water conservation, wastewater recycling, agricultural exchange and stormwater management measures that were considered but prematurely dismissed in previous studies but that continue to be advocated by the Los Osos Sustainability Group. The reasons for dismissing them were based primarily on assumptions regarding institutional and public mindset rather than technical or financial infeasibility. Those assumptions are out of date, given the harsh reality of the intrusion situation and the opportunity to concurrently solve the intrusion and wastewater problems at minimum cost.

Please do not hesitate to contact me if you have any further questions.

Sincerely,

Gus Yates, PG, CHg
Senior Hydrogeologist

HYDROFOCUS INC.
Solutions for Land and Water Resources

January 13, 2010

Mr. Keith Wimer
Los Osos Sustainability Group
1101 14th Street
Los Osos, CA 93402

Subject: Review of Cleath-Harris Geologists' July 2009 Memorandum "Flow Model Conversion and Urban Area Yield Update" (Corrected Version February 4, 2010)

Dear Mr. Wimer:

I reviewed the subject report and compared the development and results of the SEAWAT model with the results of previous studies that characterized seawater intrusion and basin yield (Cleath & Associates 2003, 2005, 2006 and Michael Brandman Associates 2008). I also contacted Spencer Harris by telephone, and he was able to provide additional information and responses to our key questions and areas of concern.

Actions are urgently needed to prevent further seawater intrusion, and they should be accompanied with monitoring and contingency measures. Because basin yield is uncertain, an adaptive management approach is needed that recognizes this uncertainty and incorporates appropriate margins of safety to prevent further intrusion in the event the expected effectiveness of the initial actions prove incorrect.

The SEAWAT model represents a step forward in more than two decades of effort towards developing models and quantitative tools to evaluate groundwater yield and quality in the Los Osos basin. The SEAWAT model flow components retain the same basic inputs (recharge and pumping rates) as the earlier "equivalent freshwater head model" that was completed in 2008 and employed for the wastewater project environmental impact report (Michael Brandman Associates, 2008). Although the reports present calibration statistics comparing simulated and measured historical water levels and salinity concentrations, they do not indicate how those statistics translate into uncertainty (i.e., potential errors) in simulated future scenarios. In all scenarios considered, groundwater use is nearly equal to the estimated basin yield. Therefore, this uncertainty in simulation results translates into a direct risk of continued overdraft and further need to reduce demand, augment supplies, or both.

In the recent SEAWAT modeling, some of the sources of uncertainty affecting safe yield estimates include the following:

1. The projected safe yield conditions are substantially different from the historical conditions used to calibrate the model in terms of the spatial distribution of groundwater extraction and recharge. Whenever a model is used to simulate conditions that deviate substantially from the calibration period, there is inherent uncertainty in the results. In this case, the "current conditions" safe yield scenario assumes that nearly two-thirds of the existing groundwater pumping from the lower aquifer (1,062 AFY) would be shifted to the upper aquifer. This change in annual upper and lower pumping rates represent a substantial redistribution of pumping stresses in the basin. While the model predicts that this increase in upper aquifer pumping can be implemented without incurring seawater intrusion, this upper aquifer pumping level has never been experienced in the basin historically nor have any of its effects been measured. Simulated pumping increases in the upper aquifer above the estimated safe yield resulted in simulated sea water intrusion at some wells (Spencer Harris, personal communication, January 5, 2010). Hence, little to no margin of error exists to accommodate the uncertainty in upper aquifer yield relative to the proposed pumping rate.

2. Recent salinity measurements in deep wells show that the model underestimates the rate of movement of the saltwater front. The chloride concentration in the Palisades well reached 250 mg/L in early 2009, indicating the seawater front advanced approximately 4,500 feet in 8 years since it first arrived at the Pecho well in 2001. In contrast, the SEAWAT model projected that the seawater front would move only about 2,000 feet over the next 50 years—less than half the distance in more than six times the period of time—as shown by Figures A-7 and A-5 of the subject memorandum. The main cause for this error is probably the assumption that the saltwater front advances uniformly through the entire cross-sectional area of the model. However in reality—as was described in the 2005 seawater intrusion report (Cleath and Associates 2005)—almost all groundwater flow is through sand lenses with relatively small cross-sectional area. For example, if permeable sand deposits comprise 10% of the basin deposits, the saltwater interface would advance approximately 10 times faster than the rate simulated by the model. Hence, fundamental uncertainty exists in the hydraulic connection between saltwater and individual wells, which translates into uncertainty in the rate of seawater advance and sustainable distribution of pumping between the shallow and deep zones. If monitoring data indicate that additional pumping shifts between the lower and upper aquifers are necessary to prevent seawater intrusion in the lower aquifer, it could exceed the ability of the upper aquifer to support production without inducing intrusion into the upper-aquifer.

3. There is uncertainty in the estimates of recharge (inflows) and pumping rates (outflows) specified as input to the model. The subject memorandum does not present the sensitivity of the yield estimate to the relative uncertainties in these flows. Specific flows that typically have relatively large uncertainty and could substantially influence the yield estimate for the Los Osos basin include:

a. Some previous studies estimated that private domestic wells extract 180-200 AFY, with little to no increase in private pumping since 1985 (Yates and Wiese 1988; Woodward-Clyde Consultants 1997; San Luis Obispo County 2007; Cleath-Harris Geologists 2009). Other studies estimated substantially lower private pumping rates, in the range of 71-88 AFY (URS Corporation 2000; Cleath and Associates 2002; Yates and Williams 2003; Michael Brandman & Associates 2008). There was no systematic chronological shift from one estimate to the other, and details supporting these estimates were presented only minimally if at all. Therefore, it appears there is uncertainty of at least 100 AFY in the amount of private domestic pumping used in the SEAWAT model. Because private domestic pumpers compete with municipal purveyors for yield, a larger estimate of private domestic pumping would result in a reduction in the expected yield that is available to the water purveyors.

b. The soil moisture budget method used to estimate rainfall recharge includes a number of parameters that are not well quantified. Two parameters that can substantially affect the average annual recharge estimate are the rainfall-runoff coefficient and the depth of the root zone for various types of vegetation. In similar water balance studies, the range of uncertainty in these parameters has been shown to correspond to a +/- 40 % variation in estimated recharge (Yates and Wiese 1988; Yates, Feeney and Rosenberg 2005). This can translate directly into a similar uncertainty in estimated aquifer yield.

c. My understanding is that Willow Creek flows are not gauged, and the ET estimate for riparian vegetation is uncertain due to coastal fog effects and unknown “crop coefficients” for natural plant species. Uncertainty in creek flow and riparian ET estimates translate directly into uncertainty in the simulated leakage from the perched aquifer to the upper aquifer and, hence, similar uncertainties in estimated aquifer yield.

d. Streambed permeability influences the simulated quantity of flow between the stream and aquifer. For example, a low permeability can decrease the amount of percolation from high winter flows while having little effect on total groundwater discharge into the lower reaches of the creek. This would shift the simulated average annual net recharge from the creek, which contributes directly to the estimated aquifer yield. This source of uncertainty is further obscured by the use of steady-state simulations.

e. The model simulates a steady-state flow regime, which can underestimate seawater intrusion impacts. During droughts, water levels typically decline as a result of the reduction in rainfall recharge and corresponding increase

in groundwater pumping, causing a relatively rapid advance of the saltwater interface. This could potentially contaminate key production wells and require that they be removed from service for a period of months or perhaps years. Even a temporary loss of pumping capacity could jeopardize the reliability of the community water supply system. Furthermore, the subsequent retreat of the saltwater interface when water levels rise during a sequence of wet years can be slower than the advance during droughts, because the rate of movement is driven more by the density difference between freshwater and seawater. So the average interface location under transient analysis might be farther inland than under steady-state analysis, possibly requiring a reduction in the estimate of basin yield.

4. Mitigation of impacts to riparian, marsh and aquatic habitats could require an allocation of basin yield that is currently not considered. The wastewater project's Draft Environmental Impact Report presented a biological analysis that overlooked one of the largest potential impacts, which is a substantial reduction in groundwater discharge to Willow Creek and wetlands in the Los Osos Creek estuary and along the Morro Bay shoreline (Michael Brandman Associates 2008). This impact results from the planned decrease in septic system percolation, not the increase in upper aquifer pumping. For example, current estimates indicate septic percolation recharge to the perched aquifer is presently about 631 AFY and groundwater outflow from the perched aquifer to streamflow and riparian ET along Willow Creek is 552 AFY. As a result of the proposed sewering, the septic system percolation decreases to 36 AFY and outflow to streamflow and riparian ET decreases to 35 AFY (a 93% reduction). Sewering would similarly decrease upper aquifer outflow to marshes around the perimeter of the urban area. If this impact is eventually evaluated and deemed to significantly impact Morro Bay shoulderband snail, steelhead trout or other sensitive species or habitats, some form of mitigation will be necessary. If mitigation includes replacement flows, that allocation of water could compete for basin yield with other water users. Thus, this issue is a source of uncertainty in the amount of yield available to water users.

The proposed management actions to address the saltwater intrusion problem do not increase basin yield, but shift the location of groundwater extraction. For example, pairing shallow and deep wells at major pumping locations provides the opportunity to adjust the proportion of water pumped from the upper and lower aquifers but it does not increase yield. Furthermore, there are limits to this strategy because of uncertainty in the capacity of the upper aquifer to support additional extractions and the possibility of seawater intrusion occurring in the upper aquifer.

Saltwater intrusion can severely affect Los Osos basin water quality, which presently is the sole source of potable water in the basin. Intrusion requires years to decades to reverse and remediate. Therefore, any prudent water management plan must include margins of safety that consider the uncertainty in estimated basin yield, monitoring,

and an adaptive management strategy that includes contingency actions that can be implemented should the proposed plan not work.

Monitoring actions need to focus on the movement of the freshwater-saltwater interface in the upper and lower aquifers. Monitoring wells located between active upper aquifer production wells and Morro Bay, and lower aquifer production wells and the present interface location can detect the continued inland migration of saltwater before impacting production wells. Monitoring wells will be particularly important in the upper aquifer, where large changes in the water balance (decreased septic recharge and increased pumping) create an increased saltwater intrusion risk. Potential impacts of sewering on riparian, marshland and aquatic organisms along Willow Creek and bay fringe marshes should also be monitored with appropriate mitigation measures ready for implementation. Contingency measures can include any actions that decrease demand, increase overall basin yield, or decrease seawater intrusion.

In summary, there is substantial uncertainty in the basin yield. Because the consequences of saltwater intrusion are severe and difficult to reverse, I conclude that a responsible water management plan must incorporate margins of safety that consider the uncertainty in estimated basin yield. This can include proactive measures to prevent intrusion (such as water conservation) and should include a monitoring program to detect any continued saltwater intrusion and contingency actions to ensure Los Osos maintains a reliable water supply.

Sincerely,

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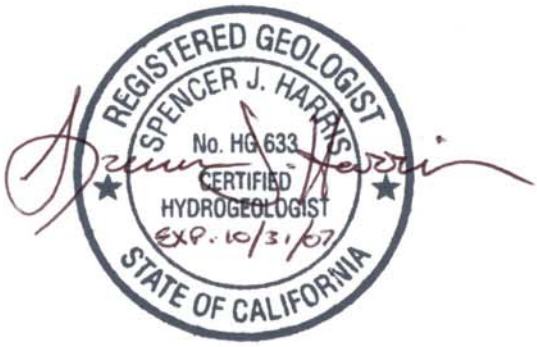
SEA WATER INTRUSION ASSESSMENT
and
LOWER AQUIFER SOURCE INVESTIGATION
of the
LOS OSOS VALLEY GROUND WATER BASIN
SAN LUIS OBISPO COUNTY, CALIFORNIA

prepared for the

LOS OSOS COMMUNITY SERVICES DISTRICT

with grant funding provided by the

CALIFORNIA DEPARTMENT OF WATER RESOURCES



October 2005

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adverse impact on the potential beneficial uses of the water. The principal criteria for evaluating sea water intrusion are water levels and water quality. According to the Ghyben-Herzberg relation, a fresh water head of approximately 5 feet would be needed to prevent the sea water interface from moving onshore within the upper aquifer. A fresh water head of approximately 9 feet would be required to prevent the sea water interface in lower aquifer Zone D from moving inland, and Zone E would require a fresh water head of approximately 17.5 feet. Currently, only upper aquifer water levels are sufficiently high to prevent sea water intrusion. The occurrence of sea water intrusion in the lower aquifer is indicated by hydraulic pressures below the minimum required to avoid intrusion based on the Ghyben-Herzberg relation, and by a landward hydraulic gradient.

Chloride concentrations define the transition zone between fresh water and sea water, with 250 milligrams per liter (mg/l) chloride representing the leading edge of the transition zone, and 2,500 mg/l chloride representing the trailing edge of the zone. Chloride concentrations in sand spit monitoring wells show increases in lower aquifer salinity of up to 100 percent between the years 1977 and 2005. Evidence of active sea water intrusion in the lower aquifer inland of the bay is shown by elevated chloride concentrations at production wells of up to 800 mg/l. Other water quality constituents, including selected major ion ratios and trace elements, have been used to confirm that the primary source of increasing chlorides in the lower aquifer is sea water. Trends in ion ratios that should accompany sea water intrusion into the lower aquifer, such as increasing chloride-to-bicarbonate, decreasing sodium-to-chloride, and increasing calcium-to-bicarbonate-plus-sulfate ratios have been documented by this study. Deterioration of lower aquifer water quality consistent with sea water mixing has also been documented using plots of bromide-to-chloride versus chloride, strontium-to-chloride versus chloride, and of oxygen-18 versus deuterium.

Conclusions of the sea water intrusion assessment are as follows:

1. The upper aquifer fresh water / sea water interface is relatively stable beneath the Morro Bay sand spit, with a potential for active intrusion during extended drought periods.

2. Sea water intrusion in lower aquifer Zone D has advanced at an average rate of 60 feet per year between 1985 and 2005, and is currently between Pecho Road and Doris Avenue.

3. Sea water intrusion in lower aquifer Zone E has advanced at an average rate of 54 feet per year between 1977 and 2005, and is currently between Broderson Avenue and Palisades Avenue.

Source of Lower Aquifer Recharge

Water quality in the lower aquifer, where not impacted by sea water intrusion, is predominantly magnesium-calcium bicarbonate and calcium-magnesium bicarbonate, with an average TDS of 340 mg/l. In the western basin area, sea water intrusion has changed lower aquifer quality from a bicarbonate anion dominance to a chloride anion dominance.

When ground water is pumped out of the lower aquifer, four potential sources of recharge are available for replenishment. These sources are the Los Osos Creek valley, the upper aquifer, bedrock, and sea water.

The creek valley source water is characterized by magnesium-calcium bicarbonate water, with a median total dissolved solids (TDS) concentration of 520 mg/l. The upper aquifer group is generally a sodium-magnesium chloride-bicarbonate water, with a median TDS concentration of 200 mg/l. Ground water quality from bedrock sources is generally magnesium-calcium bicarbonate with a median TDS concentration of 470 mg/l. Sea water has a sodium chloride character and a TDS concentration of close to 36,000 mg/l.

Numerical ground water models constructed for the ground water basin have consistently shown that the main source of recharge to the lower aquifer was leakage through the regional aquitard from the upper aquifer. This was a necessity for calibration, but was in apparent conflict with the water quality associations which correlated the magnesium-calcium bicarbonate lower aquifer water with Los Osos Creek valley water. The conflict has been resolved, and lower aquifer water quality can be closely matched by mixing up to 2.6 parts upper aquifer water with one part creek valley water. The character of the water mixture remains similar to creek valley water because of the greater ionic concentrations present in creek valley water compared to upper aquifer water.

Results of the radiocarbon age-dating of ground water also support the water quality mixing calculations that indicate significant leakage of upper aquifer water into the lower aquifer is occurring. The average age of lower aquifer water becomes younger from east to west (from 4,130 years to 2,210 years before present), which is interpreted to be caused by mixing with younger upper aquifer water.

Recharge to the lower aquifer west of the Los Osos Creek valley under current conditions is estimated to include 910 acre-feet per year of upper aquifer leakage through the regional aquitard, 420 acre-feet per year subsurface inflow from the creek valley, and 560 acre-feet per year of sea water intrusion. Recharge from bedrock is negligible.

Conclusions of the lower aquifer source investigation are as follows:

1. Lower aquifer production west of the Los Osos Creek valley is currently close to 600 acre-feet per year more than the average fresh water inflow. This is confirmed by the evidence of sea water intrusion. The Los Osos Valley ground water basin is currently in an overdraft condition.

2. The upper aquifer is the primary source of fresh water recharge to the lower aquifer, particularly on the west side of the basin. Plans originally developed during the 1980's for treated effluent disposal at higher elevations on the west side of the basin provide a reasonable potential for incidental recharge to the lower aquifer. Nitrates and other conservative constituents of basin return flows present in the upper aquifer will ultimately reach the lower aquifer.

3. Lower aquifer recharge from the southern end of the Los Osos Creek valley into the main basin area where community purveyors operate is restricted by faulting. Artificial recharge projects in the uppermost creek valley would not directly benefit the main basin area, and would require careful positioning of recovery wells with respect to local faulting.

Recommendations

The information gained through this project provides a better understanding of the dynamics of sea water intrusion and lower aquifer recharge in the Los Osos Valley ground water basin. These two issues are critical to the future management of water resources. Sea water intrusion is threatening the lower aquifer, which is the primary water supply for the community. Based on the findings and conclusions of this project, it is recommended that:

1. Lower aquifer ground water production be reduced to a level which does not exceed the average annual fresh water recharge to the aquifer. Reductions should be focused primarily on the west side of the basin, where active intrusion is occurring.

2. A basin ground water management plan be configured to mitigate sea water intrusion as a top priority, such as outlined in the July 2005 Draft Water Management Plan for the Los Osos Valley Ground Water Basin (Cleath & Associates). This plan contains a phased approach to basin management, whereby increased utilization of the upper aquifer for ground water supply allows lower aquifer recovery from the excessive draft currently being placed upon it.

3. A sea water intrusion monitoring program be implemented to provide information on the future movement of sea water and the success of mitigation measures. The recommended monitoring program is included in Part 2 of this document.

Table 1
Constant Discharge Aquifer Test Summary

Well ID	Aquifer Zone	Date	Flow (gpm)	Duration	T[1] (gpd/ft)	Screen (ft)	K[2] (gpd/ft2)
30S/11E-07N1	C	12/27/00	82	8 hours	3,900	28	140
30S/10E-13L	C	1/16/04	85	4 hours	9,000	est. 60	150
30S/11E-18K3	C	7/25/01	170	24 hours	9,500	64	150
30S/11E-18K9	C, D	12/27/00	300	8 hours	15,800	175	90
30S/11E-17E11	C, D	1/2/01	190	8 hours	4,600	80	60
30S/11E-17N10	C, D, E	2/26/01	320	24 hours	5,800	350	17
30S/11E-07Q3	D	1/4/01	180	24 hours	7,400	40	180
30S/10E-13N	D	12/7/99	150	24 hour	13,200	80	160
30S/11E-18M1	D, E	8/31/74	418	6 hours	10,500	130	80
30S/11E-18L2	D, E	3/6/86	540	12 hours	10,500	95	110
		12/29/00	750	8 hours	11,000	95	120
30S/11E-18L6	D, E	1/18/2005	50	7 hours	13,200	120	110
30S/11E-19H2	D	1/14/2005	20	12 hours	6,200	100	62
30S/10E-13M1	E	1/19/2005	50	4 hours	14,200	60	240
30S/11E-20Aa	E	2/1/2005	30	8 hours	2,930	70	42

Notes: [1]Transmissivity (T) derived from pumping test and/or recovery data using Cooper-Jacob approximation of the Theis Equation.
[2]Hydraulic conductivity (K) is based on well screen footage, not total aquifer zone thickness, and would generally represent values for the most permeable sand and gravel lenses in the aquifer zone.

Specific yield estimates for aquifer zones would be estimated based on individual lithology, and would typically range from 13% to 20% (Johnson, 1967). Storativity data is scarce in the ground water basin. Where unconfined (portions of Zone C, especially in the west basin), specific yield estimates apply. Where confined, or semi-confined (leaky), values may be several orders of magnitude lower. A review of observation well results for the pumping test conducted at a Zone C well in downtown Los Osos

(30S/11E-18K3) indicated a storativity of 0.0001 for Zone C beneath the perching clay aquitard, a confined aquifer condition (Weber, Hayes & Assoc., 2001).

Regional Aquitard

Individual clay beds in the Paso Robles Formation are generally discontinuous across the basin, with one important exception. A regional aquitard has been recognized since the early 1980's, when Brown & Caldwell (1983) noted differences in water quality above and below the clay. The regional aquitard, also referred to as the AT2 Clay (Morro Group, 1989), ranges from approximately 20 to 80 feet thick, and averages 50 feet thick over 27 locations (Cleath & Associates, 2003). Stringers of gravelly sands may be logged locally within the clay, and some of which are tapped by wells. The regional aquitard is one of the most significant geologic features in the ground water basin and separates the principal upper and lower water supply aquifers (Zone C and D, respectively). The geophysical response of the aquitard to e-logs and natural gamma logs in boreholes provides for aquitard correlation over a large portion of the basin, and also characterizes the aquitard as a layered sequence of two or more discrete clay beds in many areas. The hydraulic parameters of the clay have not been measured directly. Anisotropic hydraulic conductivity values of 0.1 feet per day (0.75 gpd/ft^2) horizontal and 0.002 feet per day (0.015 gpd/ft^2) vertical are currently used by the steady-state flow model.

Zone D - Lower Aquifer

Below the regional aquitard is lower aquifer Zone D. This is currently the primary source of the community water supply. Zone D is a Paso Robles Formation aquifer zone composed predominantly of sands and gravels.

The lithologic description of Zone D, consisting of interbedded sand, gravel, and clay, does not appear to vary as much as Zone C or Zone E across the basin. Gravel clast composition is predominantly Franciscan Formation detritus (sandstone, chert, metavolcanics) along with siliceous shales and claystones. Shell fragments are noted in Zone D lithology at wells on the sand spit and Baywood Park.

The structure of Zone D is generally conformable with the overlying aquitard, except where displaced by Quaternary faulting in the Bayview Heights area (geologic cross-section C-C'; Appendix A). The aquifer zone averages close to 100 feet thick over the central portions of the basin, thinning toward the east.

Table 1, above, includes results of aquifer tests conducted in Zone D. Hydraulic conductivity ranges from approximately 60 to 180 gpd/ft^2 (8 to 24 feet per day) in the main basin area. The results of the U.S.G.S. pumping test in 1986 at well 30S/11E-18L2, with observation well data, indicated a storativity for Zone D and E of 0.0008. This value corresponds to a confined aquifer condition (Yates and Wiese, 1986).

Alluvial Aquifer

Ground water in the alluvial aquifer of the Los Osos Creek Valley moves down the valley toward the Morro Bay Estuary. Recharge to the alluvium includes the elements listed above. Subsurface outflow from the alluvium into aquifer Zones C, D and E occurs where these zones subcrop beneath the alluvium.

Alluvial water levels are represented by well 30S/11E-20A2 (Appendix D). During drought years, water levels decline in excess of 10 feet between spring and fall, but typical seasonal fluctuations are closer to 5 feet. Many irrigation wells in the creek valley tap basin aquifers below the alluvium, where water level fluctuations are greater due to seasonal irrigation production (for example, well 30S/11E-21E4; Appendix D).

Zones A, B, and C

The perched aquifer (Zone A) receives recharge from direct percolation of precipitation and return flows from anthropogenic activities. Ground water movement in Zone A is within dune sand, and flow directions are generally northwest to northeast, with relatively steep hydraulic gradients of up to 0.06 ft/ft between Bayview Heights and downtown (parallel to the topographic slope). Flow in the perched aquifer drains to Willow Creek and issues from seeps in the Oaks Preserve and along the banks of Los Osos Creek. To the north and west, the perching clay pinches out, and ground water spills into the upper aquifer (Zone C). A ground water high between downtown Los Osos and eastern Baywood Park separates water moving to the east toward Los Osos Creek from water moving to the west toward the Morro Bay Estuary (Appendix B). In portions of downtown Los Osos and areas to the east, the transitional aquifer (Zone B) receives recharge through leakage from Zone A, and represents an intermediate hydraulic zone between the perched aquifer and the upper (water supply) aquifer.

Recharge to the upper aquifer (Zone C), occurs via the direct recharge sources itemized above, as well as through leakage from Zones A and B. Movement of ground water in Zone C is variable, but generally flows north and west toward the bay, with some easterly flow from Baywood toward Los Osos Creek. There is a pumping depression in downtown Los Osos, that draws water in from surrounding areas. The hydraulic gradients in Zone C range from 0.004 ft/ft to 0.025 ft/ft, and average approximately 0.009 feet of decline in head per foot of distance (Appendix B).

Water levels in Zone A, B, and portions of Zone C generally rose during the rapid development of the 1970's, due to increased recharge from septic return flows. Since the 1970's, seasonal fluctuation and wet period / drought cycles can be seen in these perched and upper aquifer zones, with generally stable levels overall (Appendix D). Of note is the hydrograph for well 30S/10E-14B1, completed in Zone C on the sand spit. This well shows reversed seasonal fluctuations, with higher water levels measured in the fall than the spring. Possible explanations include delayed response to seasonal pumping and/or recharge, or a seasonal fluctuation in local aquifer salinity, although the latter is not suggested from the available water quality data.

Zones D and E

Recharge and movement of ground water in the lower aquifer (Zones D and E) is the subject of the current investigation. Analysis of hydrochemical data has shown that ground water quality from lower aquifer production wells is closer in composition to Los Osos Creek alluvial water than to upper aquifer water (Brown & Caldwell, 1983). In 1988, however, the U.S.G.S. (Yates and Wiese) published a report on the Los Osos Valley ground water basin where the following observations were made based on results of a numerical model of the ground water basin (page 50):

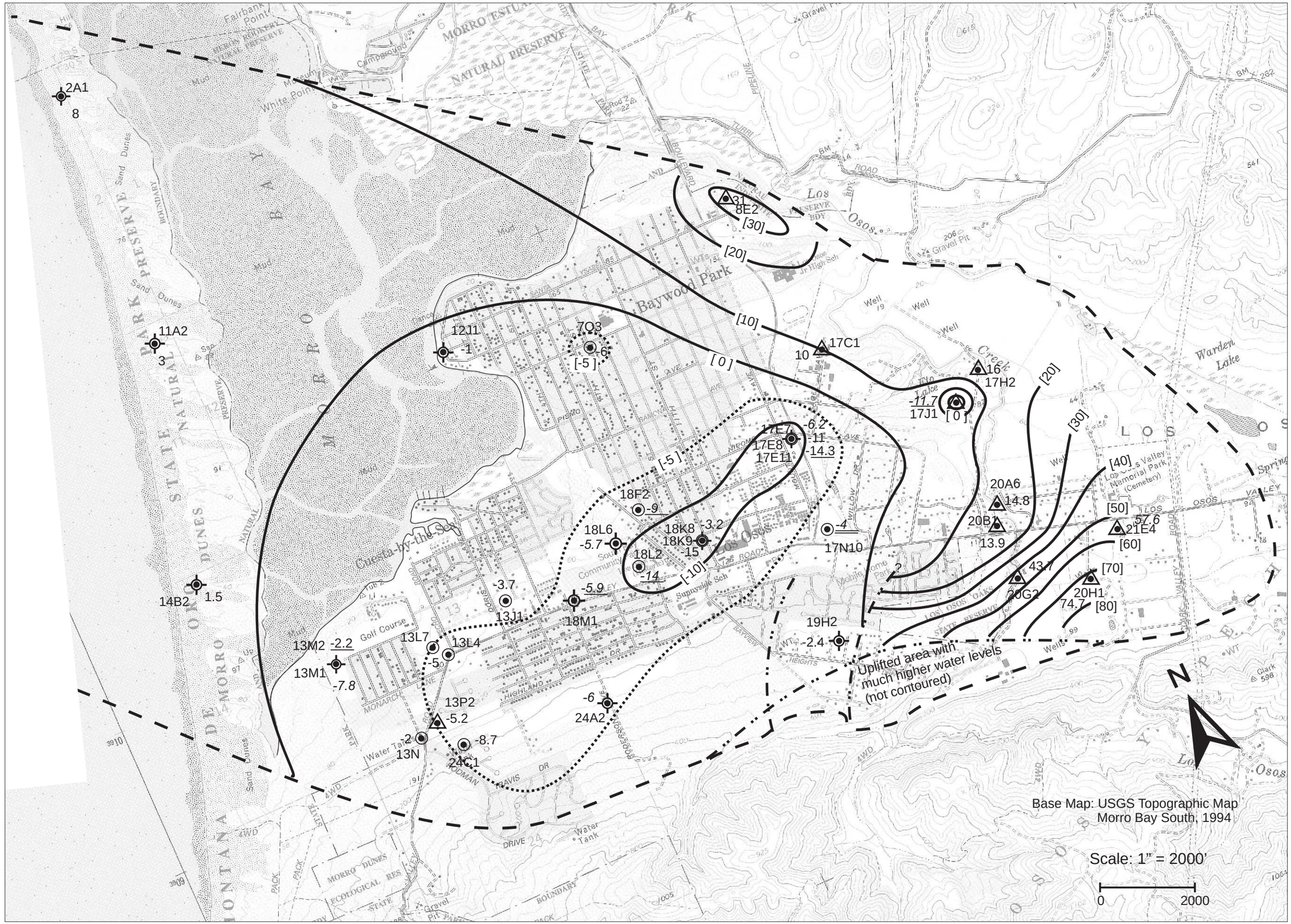
> "The downward head gradients have important long-range water-quality implications. Even in the western part of the basin, where there is an apparently continuous clay layer, model results indicated that a significant amount of recharge to deep strata must come from downward percolation of return flow. Seepage from Los Osos Creek is insufficient to supply present pumping rates, and the absence of widespread seawater intrusion indicates the ocean is also not the principal source of supply. The most likely source is downward percolation of return flow. Although at present only shallow wells have been affected by poor-quality return flow, it is likely the deep wells eventually also would be affected."

A subsequent review of nitrate concentrations over time in deep aquifer production wells showed no historical trend of increasing nitrates in the deep aquifer, while shallow aquifer nitrate concentrations were climbing (Metcalf & Eddy, 1994, Task F). These findings suggest that hydraulic communication between the upper and lower aquifer is significantly restricted by the regional AT2 clay aquitard, despite the U.S.G.S. model findings.

The basin model was later modified by URS Corporation in association with Team Engineering (2000), although the conclusions as to the principal source of recharge to the basin (septic return flows) did not change. The current basin model (Yates and Williams, 2003) also operates with the majority of recharge to the lower aquifer coming from upper aquifer leakage through the regional aquitard.

A lower aquifer ground water elevation contour map for Spring 2001 is shown in Figure 5. Ground water is generally moving toward downtown Los Osos from surrounding areas. The highest ground water elevations are in the Los Osos creek valley, and a hydraulic gradient of up to 0.03 ft/ft is inferred between the upper creek valley and downtown Los Osos. This gradient is relatively steep and suggests significant permeability restrictions, possibly fault-related, as also noted by the U.S.G.S. (Yates and Wiese, 1988).

A large area of the lower aquifer includes ground water elevations below sea level. This condition is a precursor to and a characteristic of sea water intrusion. Water levels in Zones D and E have declined over time in most areas, except the Los Osos Creek valley. These declines took place mostly during the 1970's and early 1980's. Of note, however, are continued declines at monitoring well 30S/11E-19H2 in Bayview Heights (Appendix D).



LEGEND

24A2 Lower aquifer monitoring well

17N10 Lower aquifer purveyor well

21E4 Other lower aquifer well (domestic or irrigation)

normal - Zone D elevation (shallow)
italic - Zone E elevation (deep)
italic - Zones D, E mixed
normal - Zones C, D mixed
italic - Zones C, D, E mixed

[10] Ground water elevation contour in feet above sea level Spring 2001 (some values estimated)

approx. basin limits

buried fault splay

Figure 5

Spring 2001
Ground Water Elevation
Contour Map - Lower Aquifer

DWR Grant Project
Los Osos CSD

Cleath & Associates

The results of the lower aquifer recharge investigation is presented in Part 3 of this report. Sources of recharge considered include subsurface inflow from the Los Osos Creek Valley alluvial deposits, subsurface inflow from bedrock, seawater intrusion, leakage from the upper aquifer through the regional aquitard, and wellbore flow between the upper and lower aquifer.

Ground Water Production

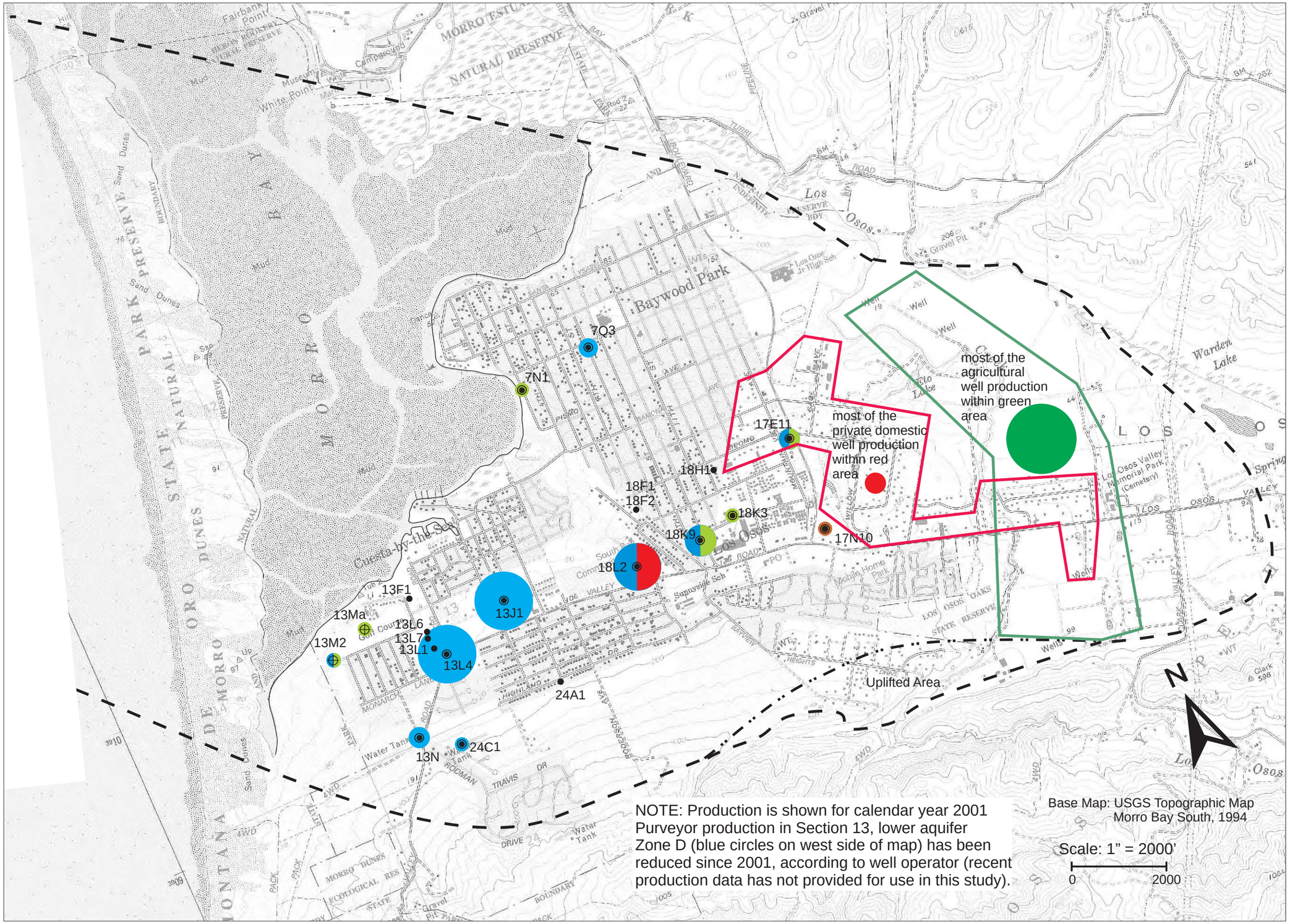
Production in the Los Osos Valley ground water basin has averaged approximately 3,500 acre-feet per year since 1985, and has been relatively stable due to a 1983 building moratorium. Production for individual aquifer zones, and by user group, is summarized below in Table 2. Estimated annual production for individual aquifer zones between 1982 and 2001 is shown in Figure 6. Purveyor production is based on actual totalizer meter readings, while private domestic and agricultural irrigation production is estimated from land use information. The distribution of ground water production in the basin by aquifer zone for calendar year 2001 is shown in Figure 7.

Table 2
1985-2001 Ground Water Production
Los Osos Valley Ground Water Basin
(acre-feet per year)

Aquifer Zone	Purveyors			Private Domestic	Agricultural Irrigation*	1985-2001 average	2001 prod.
	Cal Cities	LOCSD	S&T				
A, B	0	0	0	40	0	40	40
C, alluvium	250	230	50	120	330	980	810
D	820	630	60	40	400	1950	2170
E	0	280	0	0	220	500	380
Total	1070	1140	110	200	950	3470	3400

Note: *includes 70 afy Sea Pines golf course irrigation. Purveyor production metered. Private domestic production and agricultural irrigation production estimated based on land use.

Purveyor well water production accounts for approximately two-thirds (67%) of the total basin production, with agricultural irrigation at approximately 27%, and private domestic approximately 6% (Figure 6). The active private domestic wells are mostly located outside of the purveyor service areas, and mostly east of South Bay Boulevard. Agricultural irrigation wells are located mostly in the Los Osos



LEGEND

18H1 ● Inactive purveyor well

7N1 ◉ Active purveyor well

13Ma ⊕ Golf course irrigation well

Ground water production in acre-feet per year

- 10 to 100
- 101 to 200
- 201 to 300
- 301 to 400
- 401 to 600
- 601 to 800

Specific Major Well Production:

- Zone D
- Zone D and E mixed
- Zone C and D mixed
- Zone C
- Zone C, D and E mixed

Generalized Area production:

- Zones A, B, C, D and alluvium mixed
- Zone C, D, E and alluvium mixed

Figure 7

Ground Water Production
Los Osos Valley
Ground Water Basin
Calendar Year 2001

DWR Grant Project
Los Osos CSD

Cleath & Associates

Zone C hydraulic heads near the bay at Pecho Road have generally been in excess of 5 feet above sea level, based on static water level data from community supply well 30S/10E-13L1 (140 feet deep, drilled in 1955), except between 1989 and 1995, due to the effects of the late 1980's drought. Well 13L1 was placed on standby status in the late 1990's due to increasing nitrate concentrations, and is currently idle. Water levels at well 13L1 have generally been between 8 and 9 feet above sea level in recent years.

Zone C hydraulic heads have historically been in excess of 2.5 feet above sea level along the bay at Pasadena Drive except during severe drought, based on static water level data from community supply well 30S/11E-7N1 (84 feet deep, drilled in 1951). During and following the 1976-77 and 1987-1990 drought periods, static water levels in well 7N1 dropped to below sea level. Water levels in recent years have generally been between 5 and 6 feet above sea level at Well 7N1, which is still in active service.

In 1998, shallow water table monitoring wells were installed at Sea Pines golf course for wastewater discharge monitoring (RWQCB file review for Waste Discharge Order 93-82). Water levels at monitoring well MW3, on the west side of the golf course property, averaged 3.8 feet above sea level between October 2001 and July 2004, which is slightly lower than the hydrostatic requirements of the Ghyben-Herzberg relation (4.5 feet of head) to avoid sea water intrusion through a depth of 180 feet below sea level. As mentioned previously, however, the Ghyben-Herzberg relation would underestimate the depth to the sea water interface under ocean outflow conditions, and while the potential correction is negligible for relatively flat hydraulic gradients, it becomes significant as the outflow face is approached at the bay.

The Zone C sea water interface is currently estimated to be relatively stable onshore, with a potential for active intrusion beneath the sand spit, based on the observed hydraulic pressures and seaward hydraulic gradient. During extended drought periods, however, there is a potential for onshore sea water intrusion in Zone C, although no significant impacts to supply wells have been reported. One example of sea water intrusion near the bay was reported in a shallow well during the 1960's (DWR, 1972). The well (30S/10E-13B2) was only 20 feet deep, however, is interpreted to have been intruded by brackish water from the bay.

The earliest water level information in Zone D near the bay is from well 30S/10E-13L4, drilled in 1977. The first water level reported in May 1977 at this well was equivalent to approximately 7 feet above sea level. Under hydrostatic conditions, this would theoretically maintain fresh water saturated sediments through approximately 280 feet below sea level (Zone D extends to 320 feet below sea level at well 13L4). The e-log of the test hole, however, indicated saline water beginning at approximately 520 feet below sea level. Therefore, either sufficient ocean outflow through the aquifer zones was present in 1977 to maintain an equivalent fresh water head of 13 feet at depth, or active sea water intrusion was occurring by 1977.

Well 30S/10E-12J1, located on Pasadena Drive in Baywood Park, was drilled in 1970 and is screened in Zone E. In November and December of 1970, artesian flows with pressure heads of approximately 10 feet above sea level were reported at the well (DWR, 1972). Under hydrostatic conditions, this would

D-2: Hydrogeological Impacts Study

HOPKINS
GROUNDWATER
CONSULTANTS, INC.
THE WATER RESOURCE SPECIALISTS

October 31, 2008
Project No. 07-016-01

Michael Brandman Associates
220 Commerce, Suite 200
Irvine, California 92602

Attention: Mr. Michael E. Houlihan
Manager of Environmental Services

Subject: Final Report of Preliminary Hydrogeological Impacts Study, Los Osos Wastewater Project, Los Osos, California, Prepared for: County of San Luis Obispo, October, 2008.

Dear Houlihan:

Hopkins Groundwater Consultants, Inc. (Hopkins) is pleased to provide this final report summarizing the findings, conclusions, and recommendations of the subject preliminary hydrogeological study which analyzed the potential impacts of the proposed Los Osos Wastewater Project.

We trust the information contained in this report sufficiently describes present groundwater basin conditions and the anticipated changes that will result from the project. If you have any questions or need any additional information, please give us a call.

REGISTERED GEOLOGIST
CURTIS J. HOPKINS
EG NO. 1800
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

Sincerely,

HOPKINS GROUNDWATER CONSULTANTS, INC.

Curtis J. Hopkins
Principal Hydrogeologist
Certified Engineering Geologist EG 1800
Certified Hydrogeologist HG 114

Brian M. Cosner
Staff Hydrogeologist

c:

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advanced at an average rate of 54 feet per year between 1977 and 2005, and is approximately located between Broderson Avenue and Palisades Avenue.

GROUNDWATER QUALITY

The natural quality of groundwater in the Los Osos Basin has been of a sufficiently high quality to satisfy all overlying beneficial land uses. Since the beginning of land development, two primary sources have contributed to degradation of water quality; 1) seawater intrusion that has invaded the lower aquifer system as a result of over pumping, and 2) increasing nitrate concentrations that have resulted from the overlying land uses (i.e., septic system return flows, landscape fertilization, and domestic animal waste). Historical studies have documented the quality of groundwater in the Los Osos Basin that is delineated by aquifer zone. The following sections provide a summary of the existing total dissolved solids and nitrate concentrations in the LOWWP area.

Salts

Historical data indicate that the chemical character of water in the lower aquifers is predominantly magnesium-calcium bicarbonate and calcium-magnesium bicarbonate, with an average total dissolved solids (TDS) of 340 milligrams per liter (mg/l). Seawater intrusion in the western coastal portion of the basin has changed the lower aquifer quality from bicarbonate to chloride anion dominance.

The Los Osos Creek Valley groundwater is characteristically magnesium-calcium bicarbonate with TDS concentrations on the order of 520 mg/l. Historical groundwater quality from bedrock sources is generally magnesium-calcium bicarbonate with a median TDS concentration of 470 mg/l (C&A, 2005c).

The chemical character of groundwater in the upper aquifers is generally sodium magnesium chloride-bicarbonate water. The areas of the basin with higher TDS concentrations in shallow groundwater have been found to roughly correspond to some of the areas of higher NO_3-N concentrations. This may result from brine reject from domestic water softeners or other normal salt loading from domestic water use that is subsequently discharged from septic disposal systems. The range of TDS in the shallow groundwater is generally between 200 and 400 mg/l, with a low of 67 mg/l along South Bay Boulevard and a high of 1,100 mg/l beneath Sunset Terrace (C&A, 2005a). Table 3 – Average Groundwater and LOWWP Effluent TDS Concentrations lists the current TDS in the Los Osos Basin.

Table 3 – Average Groundwater and LOWWP Effluent TDS Concentrations

WATER SOURCE	TDS (MG/L)
PERCHED AQUIFER	400[1]
CREEK COMPARTMENT	520[2]
UPPER AQUIFER SYSTEM	330[3]
EFFLUENT	620[4]

[1] - MASS BALANCE CALCULATION BASED ON PRECIPITATION, IRRIGATION AND SEPTIC RETURN FLOWS
[2] - C&A, 2005c, PART 2, PAGE 55, PAR. 2
[3] - C&A, 2005a, TABLE 5 - AVERAGE CONCENTRATION FOR MONTH OF APRIL, 2005
[4] - FINE SCREENING REPORT, SECTION 2.3.1.1

Nitrate

Sample results from previous basin study show that NO_3-N concentrations measured in dedicated monitoring wells range from less than 1 mg/l to 28 mg/l with an overall average of 10 mg/l (NO_3-N) (C&A, 2005a). The concentrations of NO_3-N contained in groundwater in the basin and the proposed effluent to be used for disposal within the basin are listed in Table 4 – Average Groundwater and LOWWP Effluent Nitrate Concentrations.

Table 4 – Average Groundwater and LOWWP Effluent Nitrate Concentrations

WATER SOURCE	NO_3-N (MG/L)
PERCHED AQUIFER	NA
CREEK COMPARTMENT	5 TO 10[1]
UPPER AQUIFER SYSTEM	10[2]
EFFLUENT	7[3]

[1] – YEATS AND WILLIAMS, 2003
[2] - C&A 2005a, TABLE 5,
[3] - FINE SCREENING REPORT, SECTION 2.3.1.1

There is an isolated area of low NO_3-N concentrations that is inferred to extend across the open space west of the South Bay Community Library where considerable

Table 7 – Viable Project Alternative 2c

ALTERNATIVE COMPONENT	DISPOSAL OR CONSERVATION CAPACITY (AFY)		MITIGATION FACTOR	SEAWATER INTRUSION MITIGATION (AFY)	
	BUILDOUT	CURRENT		BUILDOUT	CURRENT
SPRAY FIELDS (17 ACRES)	82	0	0	0	0
BRODERSON DISPOSAL	448	448	0.22	99	99
AGRICULTURAL REUSE	690	549	0.1	46(1)	46(1)
CONSERVATION	160	160	0.55	88	88
CEMETERY REUSE	50	0	0.1	5	0
PLANT SITE IRRIGATION	20	0	0	0	0
TOTAL LOWWP DISPOSAL OR MITIGATION	**1,290**	**997**	**0**	**238**	**233**

(1) THE SEAWATER MITIGATION IS BASED ON PRESENT USE IN CREEK COMPARTMENT THAT IS OFFSET BY THE PROJECT WHICH IS THE SAME AS LEVEL 2A

DISPOSAL ALTERNATIVES IMPACTS

Description of Project Disposal/Reuse Alternatives

A gravity or STEP/STEG wastewater collection system will be constructed to collect wastewater from properties less than one acre in size within the RWQCB Prohibition Zone (see Plate 1). Wastewater will be conveyed to the newly constructed WWTP located east of the Los Osos Creek at the Branin, Giacomazzi, or Tonini sites (depending on final project alternative selection). Effluent will be treated by means of oxidation ditch, BIOLAC© wastewater treatment system, or facultative ponds. The treatment plant will be designed to process an average dry weather flow of 1.2 mgd and a peak wet weather flow of 1.5 mgd. Implementation of conservation measures throughout the prohibition area is anticipated to reduce consumption and subsequently disposal volume by 160 AFY. The total treated effluent disposal volume from the LOWWP is anticipated to be 1,290 AFY at buildout. Under current conditions the disposal volume is anticipated to be 997 AFY.

All the viable LOWWP alternatives being assessed by the County will have the same types of potential impacts to local groundwater and surface water. Each alternative includes construction of pipelines, pump stations, a treatment facility, storage

Table 8 – Current Basin Balance Conditions

COMPONENT OF WATER BUDGET	PERCHED AQUIFER	CREEK VALLEY AQUIFER	UPPER AQUIFER	LOWER AQUIFER
PERCOLATION FROM PRECIPITATION AND IRRIGATION	736	430	1,489	0
SEPTIC RETURN FLOW	631	30	606	0
SUBSURFACE OUTFLOW	0	0	- 1,310	0
SUBSURFACE INFLOW	0	167	112	0
LEAKAGE OR SUBSURFACE CROSS FLOW IN	0	117	788	1,248
LEAKAGE OR SUBSURFACE CROSS FLOW OUT	- 815	- 456	- 882	0
SEAWATER INTRUSION	0	0	0	469
LOS OSOS CREEK INFLOW	0	665	0	0
LOS OSOS CREEK OUTFLOW	0	- 77	0	0
WELL PRODUCTION	0	- 870	-803	-1,717
WARDEN DRAIN	0	- 6	0	0
WILLOW CREEK OUTFLOW AND EVAPOTRANSPIRATION	- 552	0	0	0
AQUIFER INFLOW	**1,367**	**1,409**	**2,995**	**1,717**
AQUIFER OUTFLOW	**- 1,367**	**- 1,409**	**- 2,995**	**- 1,717**

ALL TABLE QUANTITIES ARE IN ACRE-FEET PER YEAR

A comparison of the septic return flow volumes in Tables 8 and 9 shows the reduction in this component in the hydrologic budget that is effectuated by the LOWWP. Roughly half of the recharge from septic system percolation is located over the perching clay layer while the remainder is located over the upper aquifer in areas not confined by the clay layer. As indicated by the reduction in this recharge component (see Table 9) the LOWWP effectively captures over 90 percent of the septage return flows within the Los Osos Basin.

Table 9 – Viable Project Alternative 2a Basin Balance Conditions

COMPONENT OF WATER BUDGET	PERCHED AQUIFER	CREEK VALLEY AQUIFER	UPPER AQUIFER	LOWER AQUIFER
PERCOLATION FROM PRECIPITATION AND IRRIGATION	736	430	1,489	0
SEPTIC RETURN FLOW	36	30	44	0
SUBSURFACE OUTFLOW	0	0	- 1,209	0
SUBSURFACE INFLOW	0	137	100	0
LEAKAGE OR SUBSURFACE CROSS FLOW IN		103	685	1,249
LEAKAGE OR SUBSURFACE CROSS FLOW OUT	- 737	- 546	- 754	0
SEAWATER INTRUSION	0	0	0	308
LOS OSOS CREEK INFLOW	0	492	0	0
LOS OSOS CREEK OUTFLOW	0	- 168	0	0
WELL PRODUCTION (INCLUDES CONSERVATION)	0	- 390	- 803	- 1,557
WARDEN DRAIN	0	- 88	0	
WILLOW CREEK OUTFLOW AND EVAPOTRANSPIRATION	- 35	0	0	0
BRODERSON INFLOW	0	0	448	
AQUIFER INFLOW	**772**	**1,192**	**2,766**	**1,460**
AQUIFER OUTFLOW	**- 772**	**- 1,192**	**- 2,766**	**- 1,460**

ALL TABLE QUANTITIES ARE IN ACRE-FEET PER YEAR

As shown in both Tables 9 and 10 the LOWWP effectively reduces the seawater intrusion component of the lower aquifer system recharge by greater than 100 AFY. This is achieved in combination by the offsetting recharge provided by disposal at the Broderson subsurface percolation facilities and water supply conservation. As indicated both VPA 2a and 2b achieve the seawater intrusion mitigation goal. However, the main change in the hydrologic budget under these alternatives is the decrease in outflow from the perched aquifer to evapotranspiration and surface flow in the Willow Creek Drainage area.

Table 10 – Viable Project Alternative 2b Basin Balance Conditions

COMPONENT OF WATER BUDGET	PERCHED AQUIFER	CREEK VALLEY AQUIFER	UPPER AQUIFER	LOWER AQUIFER
PERCOLATION FROM PRECIPITATION AND IRRIGATION	736	430	1,489	0
SEPTIC RETURN FLOW	36	30	44	0
SUBSURFACE OUTFLOW	0	0	- 1,169	0
SUBSURFACE INFLOW	0	166	107	0
LEAKAGE OR SUBSURFACE CROSS FLOW IN	0	103	719	1,205
LEAKAGE OR SUBSURFACE CROSS FLOW OUT	- 737	- 455	- 835	0
SEAWATER INTRUSION	0	0	0	352
LOS OSOS CREEK INFLOW	0	665	0	0
LOS OSOS CREEK OUTFLOW	0	- 60	0	0
WELL PRODUCTION (INCLUDES CONSERVATION)	0	- 870	- 803	- 1,557
WARDEN DRAIN	0	- 9	0	0
WILLOW CREEK OUTFLOW AND EVAPOTRANSPIRATION	- 35	0	0	0
BRODERSON INFLOW	0	0	448	0
AQUIFER INFLOW	**772**	**1,394**	**2,807**	**1,557**
AQUIFER OUTFLOW	**- 772**	**- 1,394**	**- 2,807**	**- 1,557**

ALL TABLE QUANTITIES ARE IN ACRE-FEET PER YEAR

Analysis of Water Supply Impacts

LOWWP Facilities Construction Impacts

The sewage collection system for each alternative is effectively the same with the exception of sewage pipeline route to the final location of the LOWWP. Each collection system alternative removes septic system effluent discharges from within the prohibition zone. After treatment to a secondary level, the effluent will be conveyed to spray fields proposed for location at the Tonini site and a leach field proposed for location at the Broderson property. During construction of pipelines, pump station, and treatment facilities shallow groundwater may be encountered that requires disposal.

elevations along the bay (C&A, 2000b). The lower rate would allow disposal that would restore shallow groundwater conditions but not require harvest wells to be used to drawdown the water table along the bay. A series of groundwater monitoring wells on the site and downgradient of the site will be installed to measure groundwater levels for the purpose of reducing the rate of disposal if necessary. However, the study speculated that at any discharge rate, there may be increased potential for liquefaction beneath residences immediately downgradient of the disposal area (C&A, 2000b).

To assess the potential for liquefaction impacts to occur, the LOCSD conducted another subsurface investigation in 2004. The study conducted cone penetrometer testing to obtain site specific subsurface data around the area of proposed effluent spreading and downgradient into the adjacent community. The results of the study indicated that the potentially liquefiable soils in the vicinity of the site consisted of unconsolidated loose dune sand deposits contained within the upper 5 to 10 feet bgs. The underlying Paso Robles Formation is weakly indurated and forms a dense soil that has a low potential for liquefaction or seismic settlement to occur as a result of the effluent disposal system and the estimated groundwater mounding beneath Broderson (Fugro, 2004). The LOCSD 2004 study also conducted confirmatory field percolation testing and a prototype percolation line pilot test to provide infiltration data for correlation with the previous 1997 County study, and conducted additional laboratory soil tests to provide data for a preliminary disposal system design.

To assess the potential impacts of effluent disposal at Broderson on the underlying groundwater quality, the LOCSD performed a water quality modeling study in 2003 (Y&W, 2003). The study simulated groundwater quality changes that would result from discharge of treated effluent with an average NO3-N concentration of 7 mg/l. The study concluded that while change would be gradual over time, the removal of septic system recharge in the prohibition area and the return of treated effluent with a reduced nitrate concentration to the Broderson site would result in a beneficial impact that will improve water quality.

Short-term Construction Impacts

The entire Broderson site consists of approximately 75 acres. The leach field area as designed would occupy a rectangular area covering approximately 8 acres and the remainder would be preserved as open-space. The leach field design includes excavation of leach line trenches to an average depth of 6.5 feet during construction and subsequently re-graded. The leach fields would consist of a 4-foot depth of gravel for drainage, covered by a geotextile fabric, and then there would be at least 2.5 feet of native soil backfill. The percolation piping would consist of 4-inch perforated PVC pipe laid with the perforations facing upwards, one foot below the geotextile fabric layer. If

summarized in Appendix C of this study was utilized for the purpose of comparing current conditions and conditions estimated for the viable project alternatives (C&A, 2008b). A summary of the mass balance calculation results is provided in Appendix D – Water Quality Mass Balance Summary. Combining the average effluent concentration of 7 mg/l with all the other nitrogen sources in the Los Osos Basin the average NO3-N concentrations in the upper aquifer after LOWWP completion will be approximately 8.3 mg/l, and is below the drinking water standard. The nitrate concentration calculation results are included in Table 12 – Summary of Upper Aquifer Nitrate Loading and Average Concentrations.

The resulting average TDS concentration calculated for the upper aquifer zones with the operation of Broderson is provided in Table 13 – Summary of Upper Aquifer Average Total Dissolved Solids Concentration. Both of these results indicate Broderson will provide a beneficial water quality impact on the Los Osos Basin.

Table 12 – Summary of Upper Aquifer Nitrate Loading and Average Concentrations

BASIN CONDITION	TOTAL SURFACE RECHARGE TO LOS OSOS BASIN (AFY)	TOTAL NITROGEN LOAD (TONS)	ESTIMATED AVERAGE CONCENTRATION (MG/L)
CURRENT	3,525	52.1	10.9
BRODERSON 448 AFY	3,337	37.9	8.3
BRODERSON 896 AFY	3,785	42.1	8.2

CONCENTRATION ESTIMATE WITH NO SUBSURFACE DENITRIFICATION FOLLOWING WASTEWATER DISPOSAL

Table 13 – Summary of Upper Aquifer Average Total Dissolved Solids Concentration

BASIN CONDITION	BRODERSON DISCHARGE (AFY)	TOTAL SALTS LOAD (TONS)	ESTIMATED AVERAGE CONCENTRATION (MG/L)
CURRENT	0	1,378	352
VPA 2a	448	1,073	296
VPA 2b	448	1,097	299
VPA 2a	896	1,450	343
VPA 2b	896	1,475	345

elevations (see Appendix C) were enlarged on plates that are included in Appendix E – Water Level Contour Maps, to show the area of primary impact to the upper aquifer B and C zones. The resulting impacts of individual VPA components are tabulated in Table 14 – Los Osos Basin Water Level Impacts. The values listed in Table 14 consist of existing conditions and a comparison of simulated conditions upon project startup.

Table 14 - Los Osos Basin Water Level Impacts

PROJECT COMPONENT	UPPER AQUIFER WATER LEVEL ELEVATIONS (FEET)		LOWER AQUIFER WATER LEVEL ELEVATIONS (FEET)		UPPER AQUIFER WATER LEVEL CHANGE (FEET)		LOWER AQUIFER WATER LEVEL CHANGE (FEET)	
	ALONG THE BAY SHORE	MID BASIN	ALONG THE BAY SHORE	MID BASIN	ALONG THE BAY SHORE	MID BASIN	ALONG THE BAY SHORE	MID BASIN
EXISTING CONDITION	5	15 TO 20	-2	-5	NA	NA	NA	NA
SPRAY FIELDS ONLY	0 TO 5	5 TO 10	-5	-5	-2	-8	-2	-3
CONSERVATION ONLY	5	10 TO 15	0 TO -5	-5	-2	-6	-1	-1
BRODERSON ONLY	5	15 TO 20	0 TO -5	-5	0 TO -5	0	0 TO -1	0
AG REUSE ONLY	5	10 TO 15	0 TO -5	-3	-2	-5	-1	-1
VPA 2A	5	15 TO 20	0	0	1 TO -1	0	2	4
VPA 2B	5	15 TO 20	0	0	1 TO -1	0	0 TO 2	2

These results indicate that because Broderson discharge effectively replenishes the B and C zones beneath the perching clay, the upper aquifer water levels are virtually restored to the current condition (C&A, 2008b) (see Appendix E, Plates E1 and E2) from the 448 AFY discharge scenario. Without the Broderson disposal alternative the removal of the upper aquifer system recharge from septic system percolation (i.e., complete disposal of effluent to the Tonini spray fields) would imbalance the hydraulic equation and allow water levels to decline to near or below sea level along the bay shoreline (see Appendix E, Plate E3). The potential impact to fresh water features around the bay (i.e., springs, marshes, etc.) would be significant. In addition, the low water levels in the upper aquifer would create a vulnerability to seawater intrusion and would be a significant impact. As indicated, the potential VPA 2a water supply impacts are less than significant because of the hydrologic budget balance created by the combined project that includes the Broderson disposal site.

CONCLUSIONS

Groundwater inflow removed from the hydrologic budget (septic system percolation) by the LOWWP collection system will affect both the upper aquifer zones, which are directly recharged by this source, and the lower aquifer zones which receive leakage from the upper aquifers. However, the disposal component of the project is designed to ensure that there would not be a net loss in groundwater recharge to the aquifers that support overlying beneficial land uses and associated impacts would be less than significant. Furthermore, the proposed disposal of treated effluent at Broderson would reduce the current rate of seawater intrusion into the lower aquifer, thus resulting in a beneficial impact.

Modeling results indicate that the impact of this operation will be to restore groundwater levels in the upper aquifer system (Zones B and C) to elevations that are comparable to existing conditions. The study results indicate that Broderson disposal will provide beneficial impacts that restore groundwater recharge and maintain a balance in the hydrologic budget that provides outflows for local well production and freshwater features (marshes and springs) around the bay. Implementation of the proposed project would reduce septic effluent discharge into the perched aquifer (Zone A). Therefore, the project would reduce the quantity of groundwater within the perched aquifer. However, the exact quantity of reduction within the perched aquifer (while estimated) is unknown, and the potential impact on groundwater flow to surrounding surface water features is speculative given that the amount of perched groundwater currently flowing to surface water features is not known.

The findings of this study conclude the following:

- The impacts of shallow groundwater disposal during project construction would be less than significant if beneficially reused during construction (i.e., dust control and soil moisture conditioning of backfill soils) and/or disposed to storm drains or storm water percolation basins in accordance with RWQCB permit conditions, and/or spray disposed at Tonini site utilizing a water truck.

- Surface water runoff impacts during project construction can be mitigated with standard BMP's for erosion control to minimize the sediment load in offsite runoff.

- Runoff of irrigation water from spray field disposal would be less than significant if captured by the use of catch basins that impound the water and allow it to percolate and be reintroduced into the irrigation system.

Onsite runoff can be minimized by diverting runoff from surrounding areas outside the spray field parcels around the disposal site.

- The designed operation of the Broderson disposal alternative at the approximate capacity of 448 AFY (or greater) would reduce the potential impact of groundwater recharge losses that will result from the LOWWP elimination of septic system recharge to the main aquifers that provide water for overlying beneficial uses in the Los Osos Basin to less than significant.

- Potential geologic hazards arising from groundwater conditions created by operation of the Broderson leach field disposal will be controlled through the proper design and use of a monitoring network to track the occurrence and movement of water beneath the site and downgradient of the site. This monitoring component of the Broderson disposal alternative would allow verification that these potential impacts remain less than significant.

- The potential impact on the exact quantity of groundwater in the perched aquifer is unknown and the potential impact on groundwater flow to surrounding surface water features is speculative given that the amount of perched groundwater currently flowing to surface water features is not known.

- The proposed disposal of treated effluent at Broderson would reduce the current rate of seawater intrusion into the lower aquifer, thus resulting in a beneficial impact.

- Analyses indicates that disposal at Broderson will reduce nitrate loading and result in a beneficial impact on nutrient concentrations in the basin.

- The salinity of the upper aquifer recharge from septic system effluent is the same as the treated effluent discharge proposed at Broderson and the groundwater replenishment resulting from this discharge will have a less than insignificant impact to existing salt balance conditions in the basin.

- The TDS concentration of treated effluent that would be used for sprayfield disposal at the Tonini Ranch is estimated at approximately 620 mg/l and is comparable to the groundwater that underlies the Tonini site. Because of the similar TDS concentrations, the effects on groundwater from using the LOWWP effluent as an irrigation source versus pumping groundwater for crop irrigation are the same. Based on these conditions

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Memorandum

Date: August 7, 2008
From: Spencer Harris, Cleath & Associates
To: County staff and LOWWP consultants

Subject: **Basin hydrologic budget with simulated ground water elevation contour maps.**

This memorandum presents hydrologic budgets for the Los Osos Valley ground water basin under current conditions and under Los Osos Wastewater Project (LOWWP) viable project alternative (VPA) 2a and 2b. In addition, hydrologic budgets were prepared that isolate specific project components for use in environmental impacts analyses. The hydrologic budgets included in this memorandum and their description are shown in Table 1.

Table 1
Hydrologic Budget Scenario Descriptions

Scenario ID	Water Conservation (AFY)	Wastewater Disposal Method (AFY)		
		Spray Field	Broderson	Ag Reuse
Current Conditions	0	0	0	0
Spray Field	0	1157	0	0
Conservation	160	997	0	0
Broderson	0	709	448	0
Ag Reuse	0	677	0	480
VPA 2a	160	69	448	480
VPA 2b	160	549	448	0

Wastewater collection and disposal flows in the model are 1,157 AFY, which was the current condition estimated in 2003. Increasing wastewater flows to match plant design capacity increases spray field disposal in the above scenarios. Wastewater project scenarios were simulated based on current conditions well production to maintain consistency.

Ag reuse (combined with cemetery irrigation) was simulated at 480 AFY, which is slightly less than the sum assigned to wastewater project VPA 2a (460 AFY crop irrigation plus 50 AFY cemetery turf grass irrigation). The estimate for VPA2a was based on a nominal 230 acres of agricultural land at 2 feet of applied irrigation per year and 20 acres of cemetery turf at 2.5 feet of applied irrigation per year. Production assignments in the model are linked to individual fields and cropping patterns. The model production estimates were retained for the simulations, being more detailed and slightly conservative.

Attached to this memo are detailed hydrologic budgets, flow diagrams, and simulated ground water elevation contour maps for the seven scenarios, including a recharge zone map with pertinent accompanying tables from Yates (2003), Simulated Effects of a Proposed Sewer Project on Nitrate Concentrations in the Los Osos Valley Groundwater Basin.

Status of EFH steady state basin model

The equivalent freshwater head (EFH) steady-state basin model was used to generate the hydrologic budgets and the accompanying water level contours. Several updates have been made to the model since the 2005 sea water intrusion study. The changes include:

- Revising a portion of the Los Osos creek bed elevations to more closely match the topographic gradient of the stream channel
- Adding of Warden Creek as a drainage channel in the northeast creek valley
- Adding a general head boundary representing leakage from the Bayview Heights area into the upper aquifer.
- Merging the first two layers of the 2005 EFH model into one upper aquifer layer. The separation of the upper aquifer was a carry-over from 2003 solute transport modeling.
- Shifting a portion of purveyor production from the west side lower aquifer inland, and some production to the upper aquifer.

The current and prior model calibration statistics are shown in Table 1 below.

Table 1
Residuals Statistics

Parameter	Steady-State (2003)	Steady-State (2004 Update)	Steady-State (2005 EFH)	Steady-State (2008 EFH)
Residual Mean	2.44 feet	0.03 feet	0.57 feet	0.93 feet
Residual Standard Deviation	7.17 feet	5.61 feet	5.34 feet	4.66 feet
Absolute Residual Mean	5.59 feet	4.42 feet	4.24 feet	3.73 feet
Ratio of RSD to range	11.4%	8.9%	8.0%	7.0%
Range in head	63 feet	63 feet	67 feet	67 feet
Residual difference <10 feet	81%	92%	92%	95%
Residual difference <20 feet	100%	100%	100%	100%

A summary of the scenario hydrologic budgets are shown in Table 2. Attached to this memo are detailed hydrologic budgets, flow diagrams, and simulated upper (Zone C) and lower (Zone D) aquifer ground water elevation contour maps for the seven scenarios, including a recharge zone map with pertinent accompanying tables from Yates (2003), Simulated Effects of a Proposed Sewer Project on Nitrate Concentrations in the Los Osos Valley Groundwater Basin.

Table 2
Hydrologic Budget Summary
June 2008

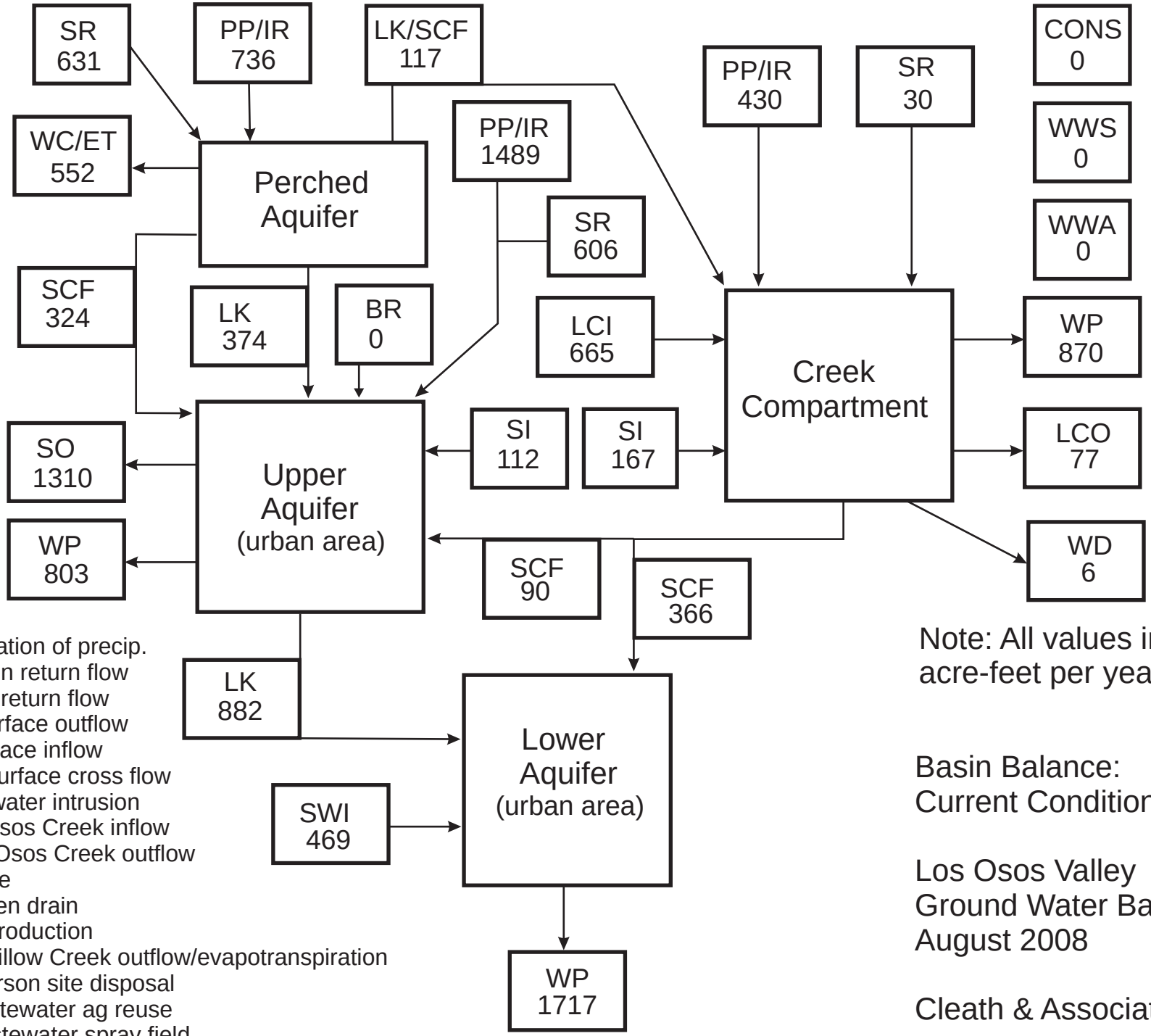
Aquifer	Budget Item (Basin IN/OUT)	Current Condition (AFY)	Component-Specific Scenarios (AFY)				Project Scenarios (AFY)	
			Spray Field	Conservation	Broderson	Ag Reuse	VPA 2a	VPA 2b
Perched Aquifer	Septic Return (IN)	631	36	36	36	36	36	36
	Percolation of precipitation/irrigation return (IN)	736	736	736	736	736	736	736
	Leakage/subsurface outflow to upper aquifer	698	634	634	634	634	634	634
	Leakage/subsurface outflow to creek compartment	117	103	103	103	103	103	103
	Willow Creek outflow/evapotranspiration (OUT)	552	35	35	35	35	35	35
Upper Aquifer	Septic Return (IN)	606	44	44	44	44	44	44
	Percolation of precipitation/irrigation return (IN)	1489	1489	1489	1489	1489	1489	1489
	Subsurface inflow from creek compartment	187	255	231	206	219	148	182
	Subsurface inflow from Bayview Heights (IN)	112	120	117	109	113	100	107
	Broderson recharge (IN)	0	0	0	448	0	448	448
	Subsurface outflow to bay/ocean (OUT)	1310	871	916	1121	910	1209	1169
	Well production (OUT)	803	803	803	803	803	803	803
	Leakage to lower aquifer	882	771	699	909	689	754	835
Creek Compartment	Septic Return (IN)	30	30	30	30	30	30	30
	Percolation of precipitation/irrigation return (IN)	430	430	430	430	430	430	430
	Los Osos Creek inflow (IN)	665	714	701	674	524	492	665
	Subsurface inflow from bedrock (IN)	167	170	169	167	141	137	166
	Los Osos Creek outflow (OUT)	77	32	38	52	126	168	60
	Warden drain (OUT)	6	2	4	6	76	88	9
	Well production (OUT)	870	870	870	870	390	390	870
	Subsurface flow to Urban Area upper aquifer	90	158	134	109	122	51	85
	Subsurface flow to Urban Area lower aquifer	366	385	387	367	514	495	370
Lower Aquifer	Sea water intrusion (IN)	469	561	471	441	514	308	352
	Well production (OUT)	1717	1717	1557	1717	1717	1557	1557

ATTACHMENTS

Hydrologic budget flow diagrams
Simulated ground water elevation contour maps
Hydrologic budget details for:
- Current Condition
- Spray Field
- Conservation
- Broderson
- Ag Reuse
- VPA 2a
- VPA 2b

Recharge Zone Map

Table 4 and Table 9 from Yates (2003)



Legend

PP = percolation of precip.
IR = irrigation return flow
SR = septic return flow
SO = subsurface outflow
SI = subsurface inflow
SCF = subsurface cross flow
SWI = sea water intrusion
LCI = Los Osos Creek inflow
LCO = Los Osos Creek outflow
LK = leakage
WD = Warden drain
WP = well production
WC/ET = Willow Creek outflow/evapotranspiration
BR = Broderson site disposal
WWA = wastewater ag reuse
WWS = wastewater spray field
CONS = water conservation

Note: All values in acre-feet per year

Basin Balance: Current Conditions

Los Osos Valley Ground Water Basin August 2008

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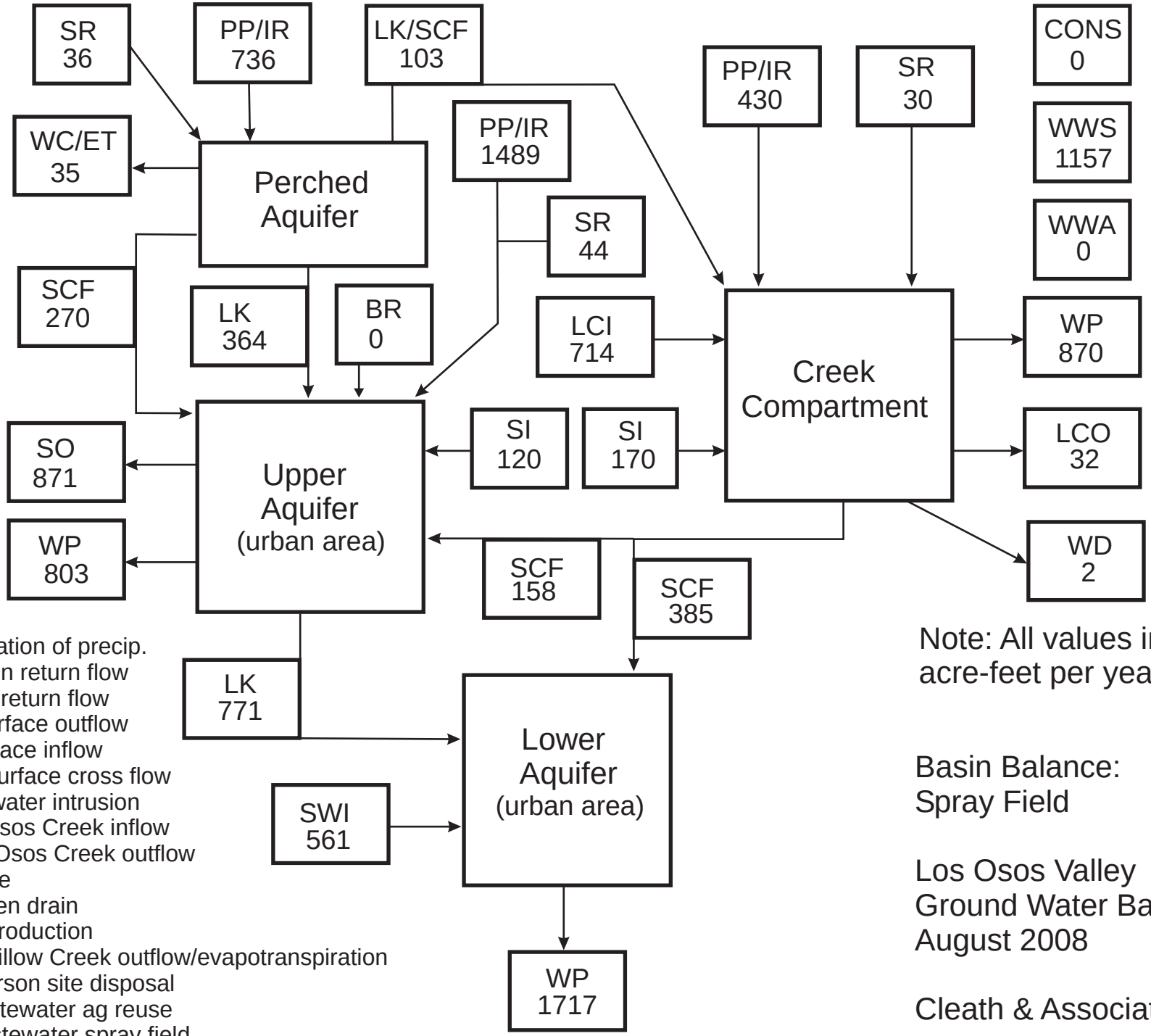

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CONS = water conservation

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Basin Balance: Spray Field

Los Osos Valley Ground Water Basin August 2008

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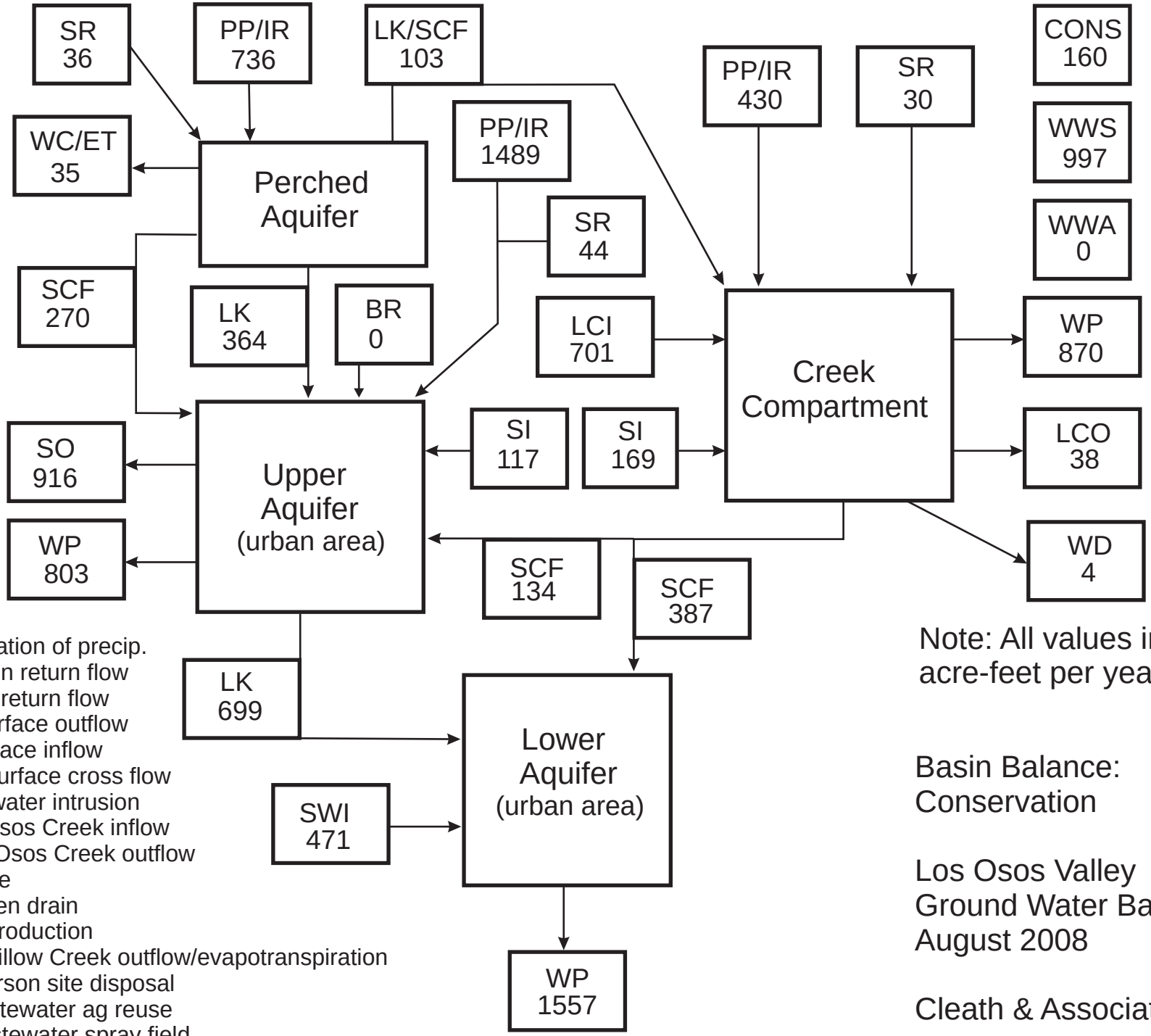

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Note: All values in acre-feet per year

Basin Balance: Conservation

Los Osos Valley Ground Water Basin
August 2008

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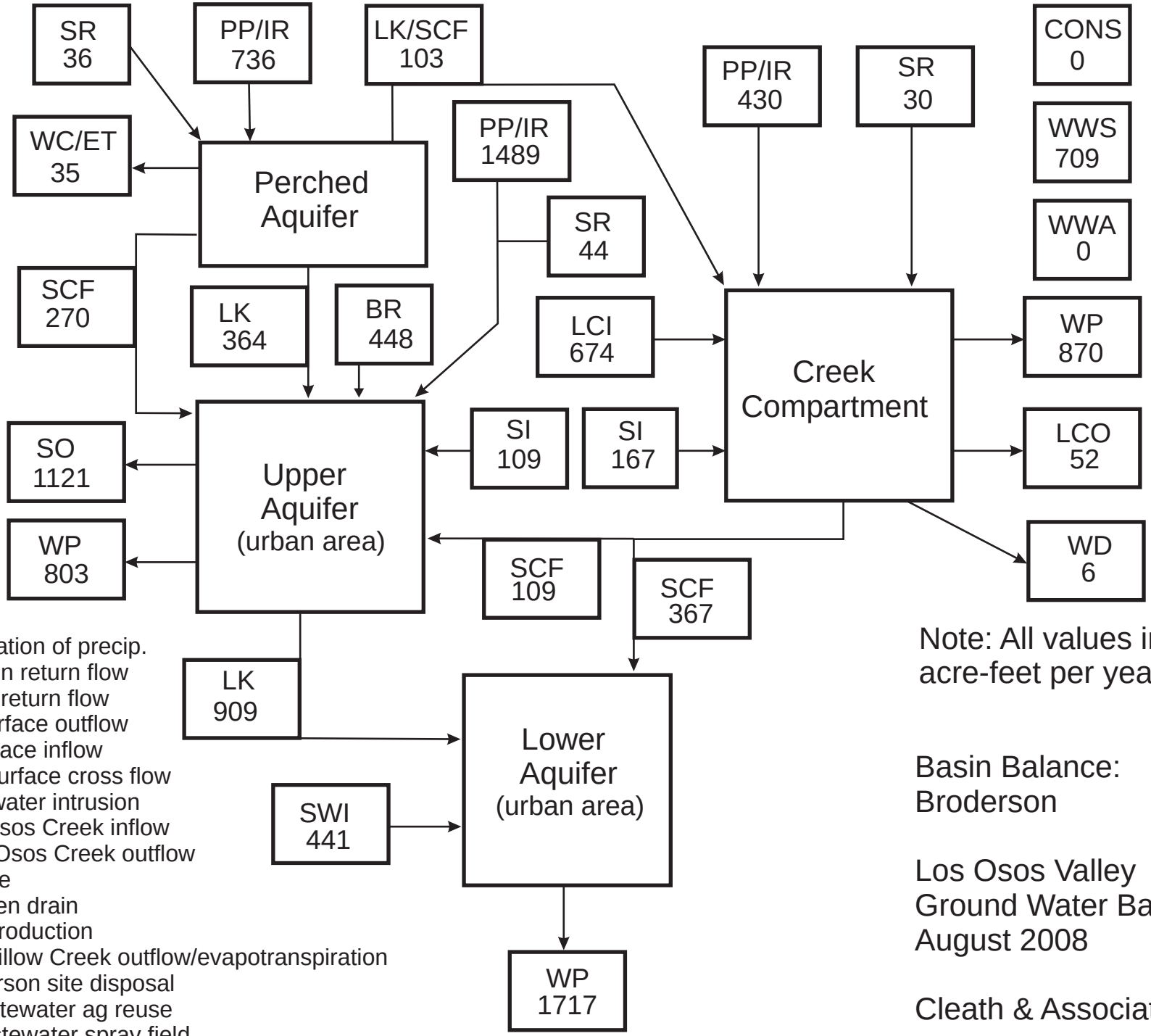

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CONS = water conservation

Note: All values in acre-feet per year

Basin Balance: Broderson

Los Osos Valley Ground Water Basin
August 2008

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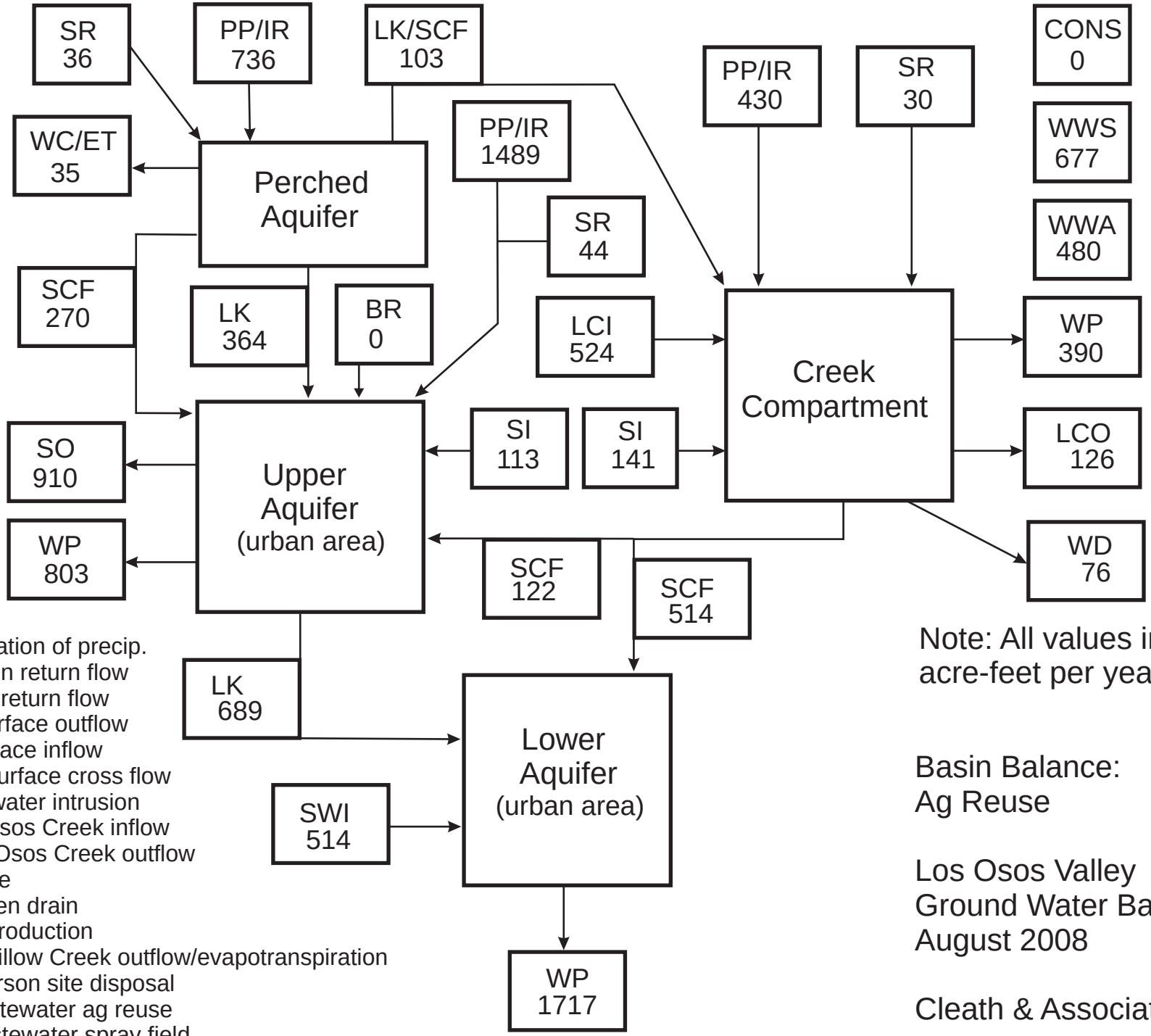

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BR = Broderson site disposal
WWA = wastewater ag reuse
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Note: All values in acre-feet per year

Basin Balance:
Ag Reuse

Los Osos Valley
Ground Water Basin
August 2008

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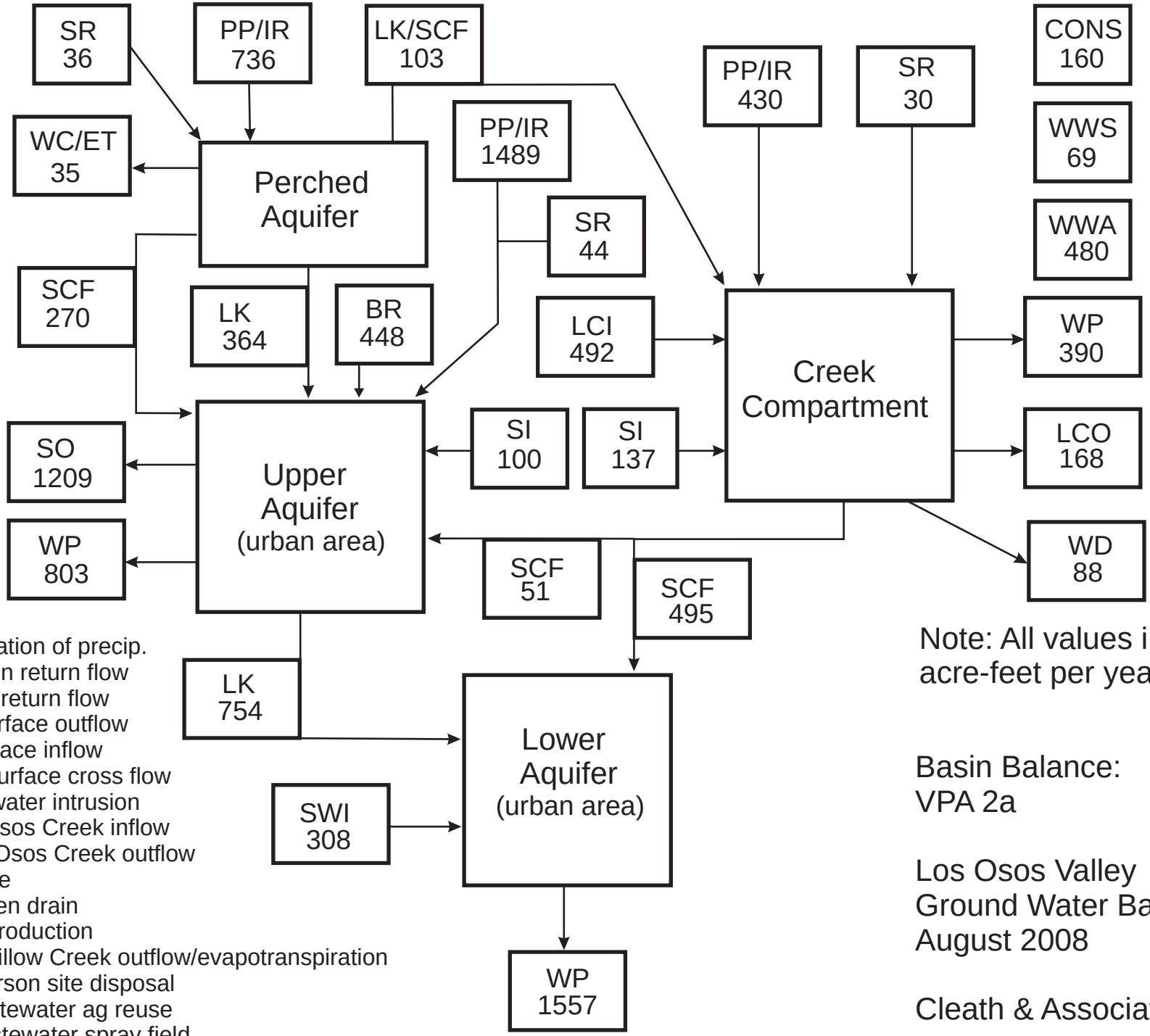

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Note: All values in acre-feet per year

Basin Balance:
VPA 2a

Los Osos Valley
Ground Water Basin
August 2008

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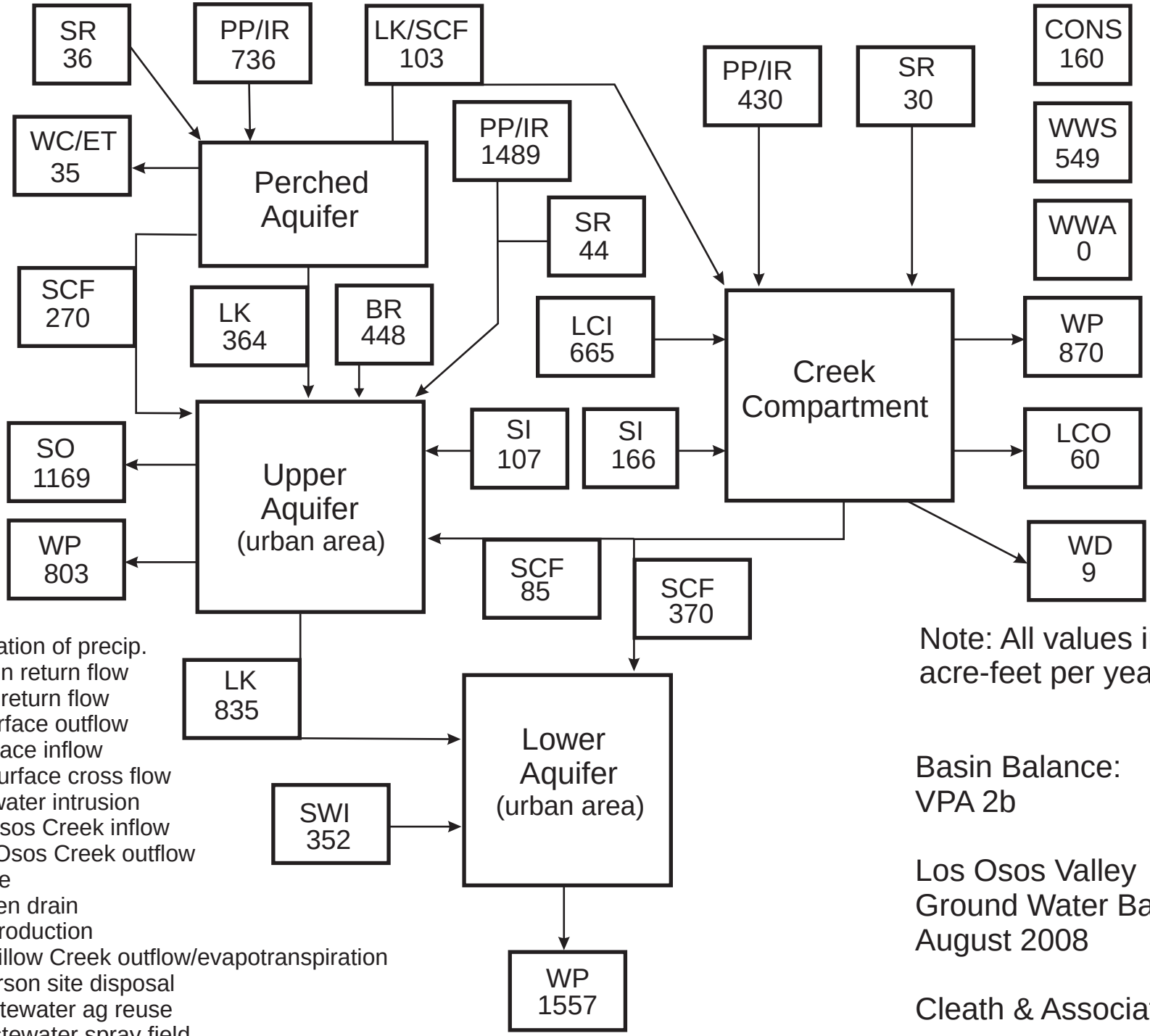

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LCO = Los Osos Creek outflow
LK = leakage
WD = Warden drain
WP = well production
WC/ET = Willow Creek outflow/evapotranspiration
BR = Broderson site disposal
WWA = wastewater ag reuse
WWS = wastewater spray field
CONS = water conservation

Note: All values in acre-feet per year

Basin Balance:
VPA 2b

Los Osos Valley
Ground Water Basin
August 2008

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present Willow Creek conditions are shown in Appendix A (see Plate A2). The creek flows a small amount during most of the year that primarily supports dense riparian vegetation. Flows in Willow Creek are fed by rising groundwater but they do not reach the bay except when Los Osos Creek is flowing to the bay. * Willow Creek supplies Los Osos Creek and the estuary.

An unnamed drainage channel in the vicinity of the mobile home park, south of Los Osos Valley Road, reportedly flows seasonally through the oak preserve into Los Osos Creek in the vicinity of Los Osos Valley Road (TMG & TES, 1990).

Table 2 – Summary of Local Surface Water Features

SURFACE WATER FEATURE	SEASONALITY	SIZE OR RATE OF FLOW	SOURCE
LOS OSOS CREEK (AT LOS OSOS ROAD BRIDGE)	EPHEMERAL	1,630 TO 4,110 AFY	MORRO GROUP, 1990
WILLOW CREEK (ETO CREEK)	EPHEMERAL	438 AFY (DISCHARGE FROM PERCHED AQUIFER)	YATES & WILLIAMS, 2003
ETO LAKE	PERENNIAL	NA	NA
SWEET SPRING	PERENNIAL	292 AFY	MORRO GROUP, 1990
SWEET SPRING MARSH	EPHEMERAL	NA	MORRO GROUP, 1990
PECHO ROAD MARSH	EPHEMERAL	NA	MORRO GROUP, 1990
THIRD STREET MARSH	NA	APPROX. 2-5 GPM OBSERVED	MORRO GROUP, 1990
BAYWOOD POINT SPRING	NA	APPROX. 5 GPM	MORRO GROUP, 1990
BAYWOOD MARSH	NA	NA	MORRO GROUP, 1990
LOS OSOS CREEK ESTUARY	NA	SEVERAL SMALL OUTFLOW CHANNELS AT APPROX. 0.5 GPM	MORRO GROUP, 1990

Flows will be reduced to near zero with the project (see Page 4 of this attachment).

From the LOWWP Draft EIR, Appendix D-2
(Available at http://www.slocounty.ca.gov/PW/LOWWP)

Table 3 – Average Groundwater and LOWWP Effluent TDS Concentrations

WATER SOURCE	TDS (MG/L)
PERCHED AQUIFER	400[1]
CREEK COMPARTMENT	520[2]
UPPER AQUIFER SYSTEM	330[3]
EFFLUENT	620[4]

[1] - MASS BALANCE CALCULATION BASED ON PRECIPITATION, IRRIGATION AND SEPTIC RETURN FLOWS
[2] - C&A, 2005c, PART 2, PAGE 55, PAR. 2
[3] - C&A, 2005a, TABLE 5 - AVERAGE CONCENTRATION FOR MONTH OF APRIL, 2005
[4] - FINE SCREENING REPORT, SECTION 2.3.1.1

Nitrate

Sample results from previous basin study show that NO_3-N concentrations measured in dedicated monitoring wells range from less than 1 mg/l to 28 mg/l with an overall average of 10 mg/l (NO_3-N) (C&A, 2005a). The concentrations of NO_3-N contained in groundwater in the basin and the proposed effluent to be used for disposal within the basin are listed in Table 4 – Average Groundwater and LOWWP Effluent Nitrate Concentrations.

Table 4 – Average Groundwater and LOWWP Effluent Nitrate Concentrations

WATER SOURCE	NO_3-N (MG/L)
PERCHED AQUIFER	NA
CREEK COMPARTMENT	5 TO 10[1]
UPPER AQUIFER SYSTEM	10[2]
EFFLUENT	7[3]

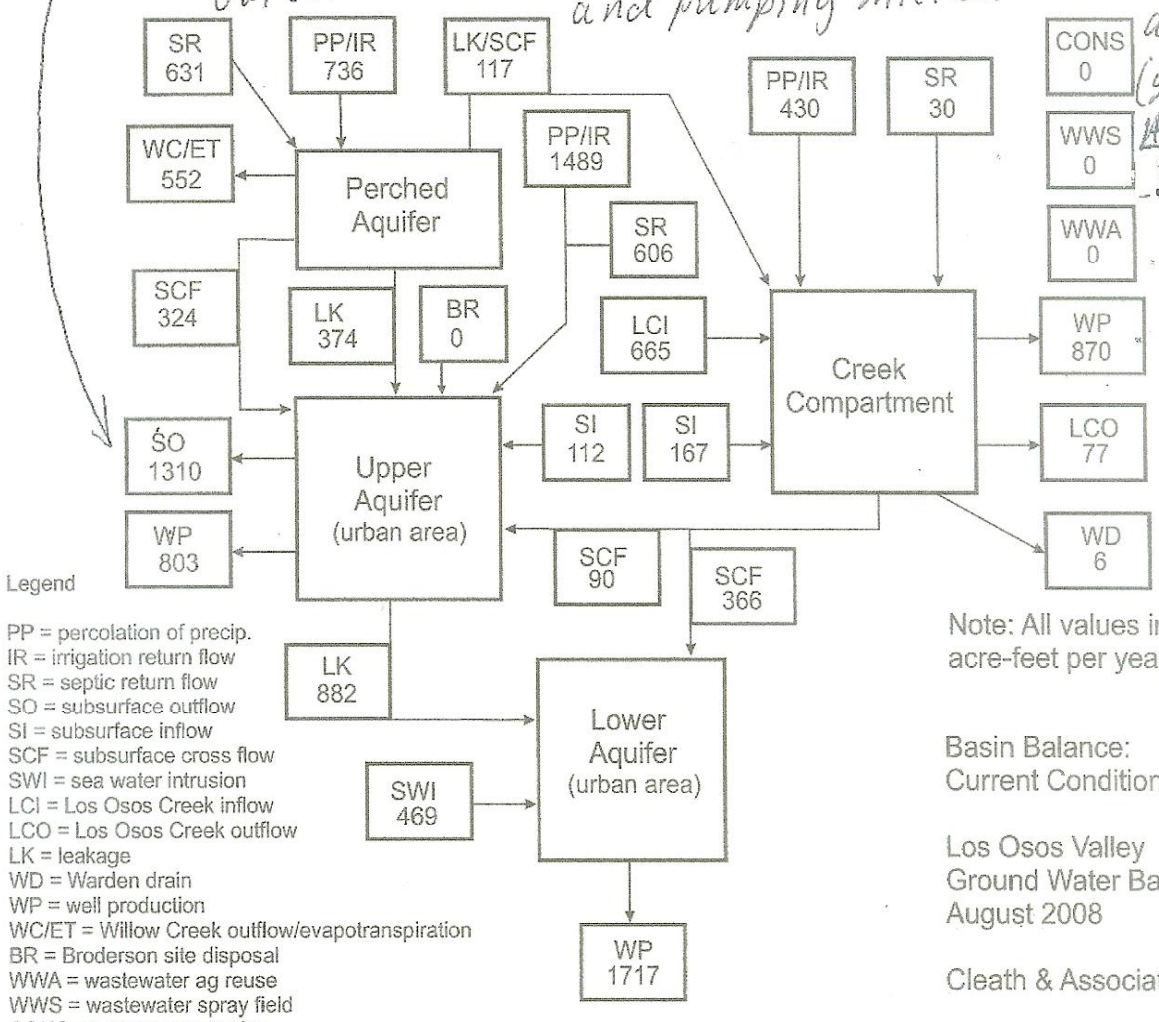
[1] – YEATS AND WILLIAMS, 2003
[2] - C&A 2005a, TABLE 5,
[3] - FINE SCREENING REPORT, SECTION 2.3.1.1

Average nitrate levels are at drinking water standards.

There is an isolated area of low NO_3-N concentrations that is inferred to extend across the open space west of the South Bay Community Library where considerable

From Appendix C of
DEIR Appendix D-2

Current outflows to the ocean from the upper aquifer. This is needed to prevent sea water intrusion in the upper aquifer. Outflows are reduced by 400 AFY w/ the project and pumping shifted to the upper aquifer (see Attachmnt 32 pp3, 4)



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WWS = wastewater spray field
CONS = water conservation

Note: All values in acre-feet per year

Basin Balance: Current Conditions

Los Osos Valley Ground Water Basin
August 2008

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DEIR Appendix D-2

These outflows are needed to prevent sea water intrusion in the upper aquifer (see p. 14 of Appendix D-2; also Attachment 4)

Table 8 – Current Basin Balance Conditions

COMPONENT OF WATER BUDGET	PERCHED AQUIFER	CREEK VALLEY AQUIFER	UPPER AQUIFER	LOWER AQUIFER
PERCOLATION FROM PRECIPITATION AND IRRIGATION	736	430	1,489	0
SEPTIC RETURN FLOW	631	30	606	0
SUBSURFACE OUTFLOW	0	0	- 1,310	0
SUBSURFACE INFLOW	0	167	112	0
LEAKAGE OR SUBSURFACE CROSS FLOW IN	0	117	788	1,248
LEAKAGE OR SUBSURFACE CROSS FLOW OUT	- 815	- 456	- 882	0
SEAWATER INTRUSION	0	0	0	469
LOS OSOS CREEK INFLOW	0	665	0	0
LOS OSOS CREEK OUTFLOW	0	- 77	0	0
WELL PRODUCTION	0	- 870	-803	-1,717
WARDEN DRAIN	0	- 6	0	0
WILLOW CREEK OUTFLOW AND EVAPOTRANSPIRATION	- 552	0	0	0
AQUIFER INFLOW	**1,367**	**1,409**	**2,995**	**1,717**
AQUIFER OUTFLOW	**- 1,367**	**- 1,409**	**- 2,995**	**- 1,717**

ALL TABLE QUANTITIES ARE IN ACRE-FEET PER YEAR

The flows are currently supporting Willow Creek, raparian habitat.

A comparison of the septic return flow volumes in Tables 8 and 9 shows the reduction in this component in the hydrologic budget that is effectuated by the LOWWP. Roughly half of the recharge from septic system percolation is located over the perching clay layer while the remainder is located over the upper aquifer in areas not confined by the clay layer. As indicated by the reduction in this recharge component (see Table 9) the LOWWP effectively captures over 90 percent of the septage return flows within the Los Osos Basin.

October 2008
Project No. 07-016-01

HOPKINS GROUNDWATER CONSULTANTS

A reduction in outflows from upper aquifer (141 AFY) increases likelihood of seawater intrusion. Outflows decrease by 400 AFY w/ more pumping from upper aquifer (see Attachment 32 pp. 3, 4)

Table 10 – Viable Project Alternative 2b Basin Balance Conditions

COMPONENT OF WATER BUDGET	PERCHED AQUIFER	CREEK VALLEY AQUIFER	UPPER AQUIFER	LOWER AQUIFER
PERCOLATION FROM PRECIPITATION AND IRRIGATION	736	430	1,489	0
SEPTIC RETURN FLOW	36	30	44	0
SUBSURFACE OUTFLOW	0	0	- 1,169	0
SUBSURFACE INFLOW	0	166	107	0
LEAKAGE OR SUBSURFACE CROSS FLOW IN	0	103	719	1,205
LEAKAGE OR SUBSURFACE CROSS FLOW OUT	- 737	- 455	- 835	0
SEAWATER INTRUSION	0	0	0	352
LOS OSOS CREEK INFLOW	0	665	0	0
LOS OSOS CREEK OUTFLOW	0	- 60	0	0
WELL PRODUCTION (INCLUDES CONSERVATION)	0	- 870	- 803	- 1,557
WARDEN DRAIN	0	- 9	0	0
WILLOW CREEK OUTFLOW AND EVAPOTRANSPIRATION	- 35	0	0	0
BRODERSON INFLOW	0	0	448	0
AQUIFER INFLOW	**772**	**1,394**	**2,807**	**1,557**
AQUIFER OUTFLOW	**- 772**	**- 1,394**	**- 2,807**	**- 1,557**

ALL TABLE QUANTITIES ARE IN ACRE-FEET PER YEAR

Flows to Willow Creek are reduced by 517 AFY obviously causing as

Analysis of Water Supply Impacts

LOWWP Facilities Construction Impacts

The sewage collection system for each alternative is effectively the same with the exception of sewage pipeline route to the final location of the LOWWP. Each collection system alternative removes septic system effluent discharges from within the prohibition zone. After treatment to a secondary level, the effluent will be conveyed to spray fields proposed for location at the Tonini site and a leach field proposed for location at the Broderson property. During construction of pipelines, pump station, and treatment facilities shallow groundwater may be encountered that requires disposal.

elevations along the bay (C&A, 2000b). The lower rate would allow disposal that would restore shallow groundwater conditions but not require harvest wells to be used to drawdown the water table along the bay. A series of groundwater monitoring wells on the site and downgradient of the site will be installed to measure groundwater levels for the purpose of reducing the rate of disposal if necessary. However, the study speculated that at any discharge rate, there may be increased potential for liquefaction beneath residences immediately downgradient of the disposal area (C&A, 2000b). Broderson leach fields are not certain to percolate effluent at the rate predicted.

To assess the potential for liquefaction impacts to occur, the LOCSD conducted another subsurface investigation in 2004. The study conducted cone penetrometer testing to obtain site specific subsurface data around the area of proposed effluent spreading and downgradient into the adjacent community. The results of the study indicated that the potentially liquefiable soils in the vicinity of the site consisted of unconsolidated loose dune sand deposits contained within the upper 5 to 10 feet bgs. The underlying Paso Robles Formation is weakly indurated and forms a dense soil that has a low potential for liquefaction or seismic settlement to occur as a result of the effluent disposal system and the estimated groundwater mounding beneath Broderson (Fugro, 2004). The LOCSD 2004 study also conducted confirmatory field percolation testing and a prototype percolation line pilot test to provide infiltration data for correlation with the previous 1997 County study, and conducted additional laboratory soil tests to provide data for a preliminary disposal system design.

To assess the potential impacts of effluent disposal at Broderson on the underlying groundwater quality, the LOCSD performed a water quality modeling study in 2003 (Y&W, 2003). The study simulated groundwater quality changes that would result from discharge of treated effluent with an average NO3-N concentration of 7 mg/l. The study concluded that while change would be gradual over time, the removal of septic system recharge in the prohibition area and the return of treated effluent with a reduced nitrate concentration to the Broderson site would result in a beneficial impact that will improve water quality.

Short-term Construction Impacts

The entire Broderson site consists of approximately 75 acres. The leach field area as designed would occupy a rectangular area covering approximately 8 acres and the remainder would be preserved as open-space. The leach field design includes excavation of leach line trenches to an average depth of 6.5 feet during construction and subsequently re-graded. The leach fields would consist of a 4-foot depth of gravel for drainage, covered by a geotextile fabric, and then there would be at least 2.5 feet of native soil backfill. The percolation piping would consist of 4-inch perforated PVC pipe laid with the perforations facing upwards, one foot below the geotextile fabric layer. If

Eight acres of ESHA will be destroyed and redisturbed every 5-10 years (leachfield material excavated and ground beneath disked)

Table 11 - Effluent Water Limitations from Previous Discharge Requirements (Order No. R3-2003-0007)

EFFLUENT LIMITATIONS			
CONSTITUENT	UNITS	MONTHLY AVERAGE	DAILY MAXIMUM
SETTLEABLE SOLIDS	MG/L	0.1	0.5
BOD*, 5-DAY	MG/L	60	100
SUSPENDED SOLIDS	MG/L	60	100
TOTAL NITROGEN (AS N)	MG/L	7	10

*Biological Oxygen Demand

The treatment facilities are being designed to produce an effluent that will have an average NO_3-N concentration of 7 mg/l and an estimated TDS concentration of 620 mg/l (Carollo, 2007b). The average nitrate concentration presently in the Los Osos Basin in the proximity of the prohibition zone groundwater is on the order of 10 mg/l (NO_3-N) (Y&W, 2003) and the average TDS concentration is approximately 330 mg/l (C&A, 2005c).

Effluent disposed at Broderson would have a positive affect on slowing the current conditions of seawater intrusion in the lower aquifer zones and flushing nitrate laden water from upper aquifer zones. The slow turnover rate of groundwater has been identified as the single most important basin characteristic affecting water-quality trends in the Los Osos Basin (Y&W, 2003). This occurs because the volume of groundwater in storage is relatively large compared to annual inflows and outflows. The result is that any action to decrease nitrogen loading (i.e., the LOWWP) will take a relatively long time to have an effect. As a result, nitrate concentrations in some deep wells may continue to increase for many years before the effect of septage removal reaches the lower aquifer system. Recent study has concluded that the shallow aquifer system may take on the order of three decades to equilibrate to a change in nitrate loading (Y&W, 2003). Regardless of the time frame required to realize a reduction in nitrate concentrations across the Los Osos Basin this impact is considered a beneficial impact to the basin.

It will take 30 years for nitrates to be reduced 1.7 mg/l.

To assess the impacts of TDS and NO3-N concentrations in the Los Osos Basin caused by effluent disposal at Broderson, a mass balance calculation was performed using septic return flows, precipitation, irrigation, subsurface cross flows and effluent disposed at Broderson at a rate of 448 AFY. The hydrologic budget

This statement is made prior to purveyors indicating they plan to treat the water for nitrates to increase use.

From the LOWWP Draft EIR, Appendix D-2
(Available at http://www.slocounty.ca.gov/PW/LOWWP)

summarized in Appendix C of this study was utilized for the purpose of comparing current conditions and conditions estimated for the viable project alternatives (C&A, 2008b). A summary of the mass balance calculation results is provided in Appendix D – Water Quality Mass Balance Summary. Combining the average effluent concentration of 7 mg/l with all the other nitrogen sources in the Los Osos Basin the average NO3-N concentrations in the upper aquifer after LOWWP completion will be approximately 8.3 mg/l, and is below the drinking water standard. The nitrate concentration calculation results are included in Table 12 – Summary of Upper Aquifer Nitrate Loading and Average Concentrations.

The resulting average TDS concentration calculated for the upper aquifer zones with the operation of Broderson is provided in Table 13 – Summary of Upper Aquifer Average Total Dissolved Solids Concentration. Both of these results indicate Broderson will provide a beneficial water quality impact on the Los Osos Basin.

Table 12 – Summary of Upper Aquifer Nitrate Loading and Average Concentrations

BASIN CONDITION	TOTAL SURFACE RECHARGE TO LOS OSOS BASIN (AFY)	TOTAL NITROGEN LOAD (TONS)	ESTIMATED AVERAGE CONCENTRATION (MG/L)
CURRENT	3,525	52.1	10.9
BRODERSON 448 AFY	3,337	37.9	8.3
BRODERSON 896 AFY	3,785	42.1	8.2

CONCENTRATION ESTIMATE WITH NO SUBSURFACE DENITRIFICATION FOLLOWING WASTEWATER DISPOSAL

Currently (2005) avg. = 10mg/l *(see Page 2 of this attachment).

Table 13 – Summary of Upper Aquifer Average Total Dissolved Solids Concentration

BASIN CONDITION	BRODERSON DISCHARGE (AFY)	TOTAL SALTS LOAD (TONS)	ESTIMATED AVERAGE CONCENTRATION (MG/L)
CURRENT	0	1,378	352
VPA 2a	448	1,073	296
VPA 2b	448	1,097	299
VPA 2a	896	1,450	343
VPA 2b	896	1,475	345

The Broderson disposal recharge can not mitigate potential impacts of reduced groundwater outflow that drains out of the upper aquifer A zone toward the Willow Creek drainage or directly into the bay. The annual drainage in the Willow Creek area will be reduced by the LOWWP to natural or above natural conditions prior to the Los Osos community development. Drainage will still occur, however the flow rates may be reduced to the present ephemeral surface flows. The potential impacts of the reduced groundwater discharge in this area of the Los Osos Basin could be realized along the riparian corridors of the drainage features. However, seasonal runoff and shallow groundwater are anticipated to provide sufficient water for use by the riparian vegetation established well before the Los Osos community was developed.

↖ Potential impacts to Willow Creek and other habitat are acknowledged but not mitigated (i.e., the reduction of over 500 AFY of groundwater flows to ESHA).

Hydrogeologic Hazards

Potential hydrogeological hazards identified by this study are focused around the Broderson disposal site. Potential hazards include increased rising groundwater in the community at lower elevations around the bay, groundwater seepage from slope faces below the leach field, or liquefaction of soils between the site and the points of onshore and offshore discharge. Specific studies have been conducted to assess the potential for each of these impacts to occur.

As previously mentioned, water level elevation changes in the vicinity of the site and across the Los Osos Basin in the upper aquifer zones were modeled as part of the project design study. The design capacity of 448 AFY was selected based on the ability of the aquifer system to receive this annual quantity of water without developing adverse conditions. The reduced design capacity alleviates hazards that could be caused by discharge at a higher rate. This rate reduces mounding beneath the site to eliminate the potential for groundwater to flow laterally and exacerbate saturated soil hazards near the bay. The design rate minimizes the potential for additional rising groundwater around the bay at lower elevations. While this condition presently exists in many low lying areas around the bay, the proposed disposal capacity at startup is designed to maintain existing conditions and not exacerbate this potential hazard. Liquefaction is a hazard that was specifically studied by the LOCSD to understand the potential for its occurrence (Fugro, 2004). The result of the field tests indicated that the potential was low because of the nature of the underlying geologic formation which was comprised of dense soils beneath the dune sands.

While project studies indicate that potential risk for these hazards is low, the occurrence of these potential impacts would be controlled during operation by the installation of a monitoring network at the Broderson site and downgradient within the residential community prior to initiating discharge. The groundwater monitoring network would allow direct observation of the changes in groundwater conditions and appropriate adjustments to the disposal operations can be made. In addition, if

ISJ. Tech Memo "Flow Model Conversion and Urban Area Yield" Cleath-Harris Geologists, Inc. July 29, 2009

CHG

A sustainability test is performed on the steady-state results. If the chlorides at a producing purveyor well exceeds 250 mg/l due to sea water intrusion, the yield is assumed to be unsustainable. Simulations are run until a sustainable yield is achieved. The optimum yield solution is reached when the difference between sustainable and unsustainable yield is reduced to approximately 50 acre-feet. Using this methodology, the updated yield for the basin under current conditions is shown below in Table 2.

This allows water supply to degrade and is not consistent with the Clean Water Act.

Table 2
Basin Safe Yield Estimate - Current Conditions

Basin Area	Basin User	Yield (AFY)
Urban Area	Purveyor wells	2,100
	Sea Pines Golf Course	100
	Rural Residential (East side)	125
Creek Valley	Rural Residential (creek valley)	75
	Creek Valley (ag irrigation wells)	800
Basin Total		3,200

The overall basin yield estimate under current conditions (assuming no creek valley surplus water development) is 3,200 acre-feet per year. After subtracting 1,100 AFY in agricultural irrigation, private domestic use, and golf course irrigation, the purveyors have an estimated 2,100 AFY of sustainable yield. This is comparable to the current level of community demand, which has averaged approximately 2,040 AFY over the last five years (attached).

Balancing the basin, however, requires a significant redistribution of pumping between the upper and lower aquifers. These aquifers are not independent, and yield values should be interpreted accordingly. More lower aquifer yield can be obtained at the expense of upper aquifer yield, and vice-versa.

For the balanced basin simulation of current conditions listed in Table 2, the upper aquifer yield is 1,700 AFY and the lower aquifer yield is 1,500 AFY (basin-wide). The distribution of upper aquifer versus lower aquifer yield varies across the basin, however, with most of the lower aquifer yield in the East side and creek valley. For purveyor wells in the urban area, the yield distribution for a current conditions balanced basin is 1,490 AFY upper aquifer and 620 AFY lower aquifer.

One hypothetical optimum solution for urban area purveyor well production that mitigates sea water intrusion under current conditions is given below in Table 3. Figures showing seawater intrusion at 50 years, 500 years, and steady state, with chemographs for representative wells are attached. A hydrologic budget flow diagram is also attached. Note that 55 AFY of sea water intrusion continues to enter the basin, where it dilutes to below 250 mg/l chloride before reaching active production wells.

Chloride levels allowed to rise in some wells - not a true safe yield.

Table 3
Potential Purveyor Well Production under Current Septic Conditions

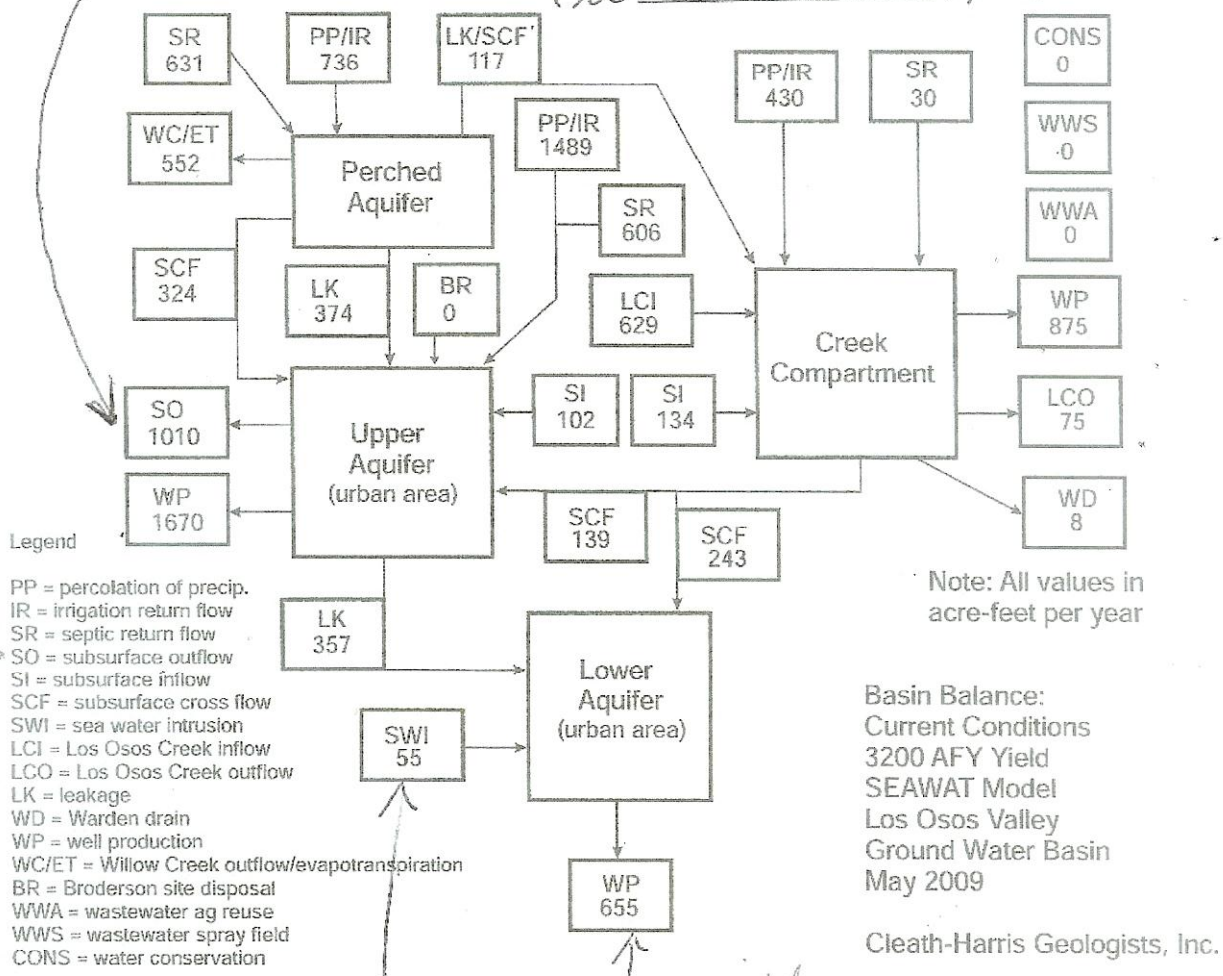
Purveyor	Well	Production (AFY)
GSWC	Upper Aquifer	740
	Lower Aquifer	310
	GSWC TOTAL	1,050
	Upper Aquifer	650
	Lower Aquifer	300
	LOCSD TOTAL	950
S&T	Upper Aquifer	100
PURVEYOR TOTAL		2,100

Note: Other optimum yield pumping distributions are possible. The actual distribution of well production would be subject to purveyor agreement.

Wastewater Project Conditions Yield

The same methodology was applied to the wastewater scenarios. Two wastewater scenarios have been simulated: Spray Field only and a VPA2b. Results of the wastewater project conditions yield simulations are shown below in Table 4.

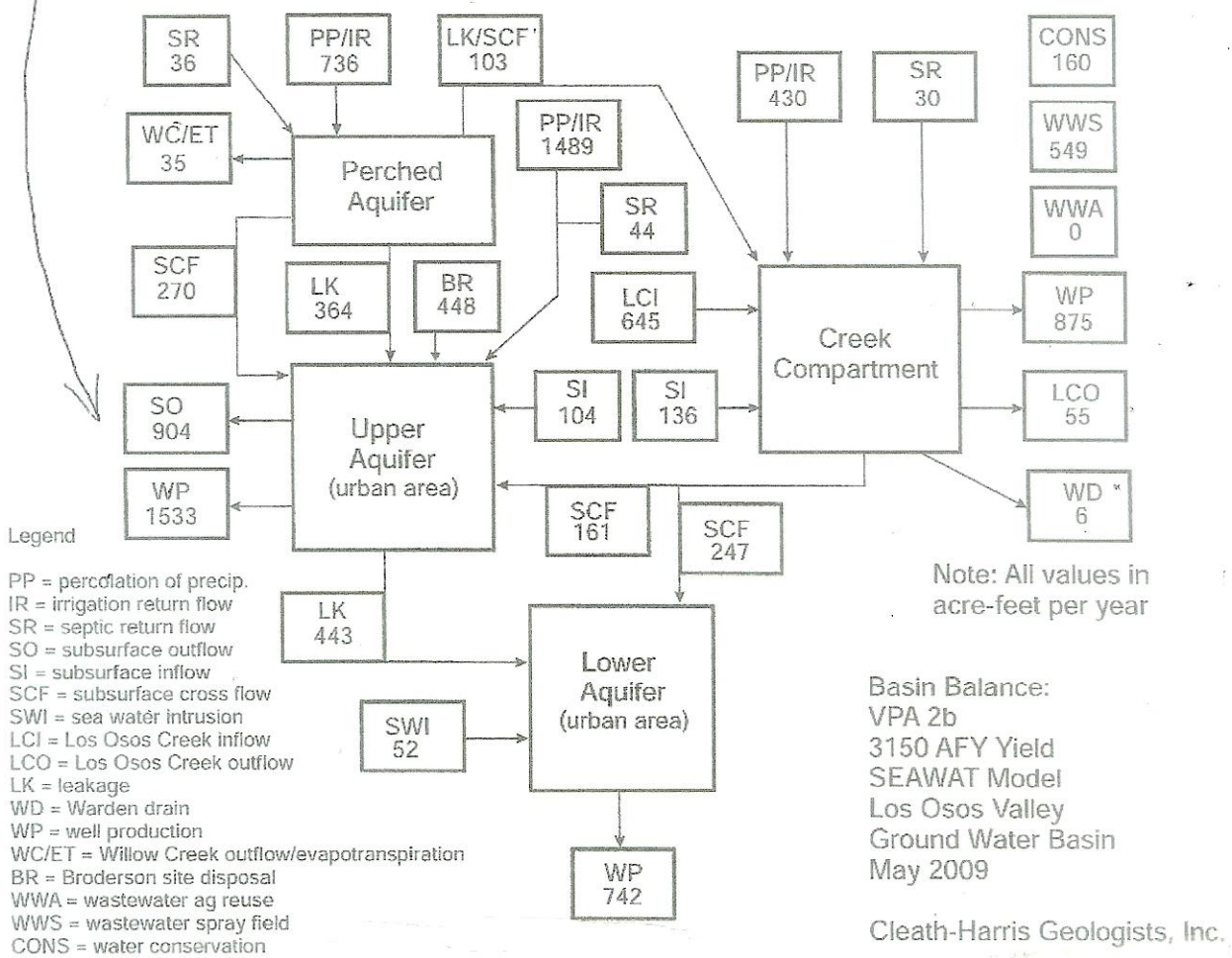
Outflows to ocean decrease w/ increased pumping, increasing likelihood of seawater intrusion. Current outflows w/o the project are estimated to be 1310 AFY (see Attachment 20, p.3)



Seawater intrusion continues

Safe yield must be under 600.

Outflows to ocean are reduced 400 AFY with increased upper aquifer pumping and the project. (See Attachment 2.0 p.3 for current estimated flows.)



STATE OF CALIFORNIA
CENTRAL COAST WATER BOARD
Received
JUL 18 2006
895 Aerovista Place, Ste. 101
San Luis Obispo, CA 93401-7906

TASK 3

LOS OSOS UPPER AQUIFER WATER QUALITY CHARACTERIZATION

Prepared for the

LOS OSOS COMMUNITY SERVICES DISTRICT

REGISTERED GEOLOGIST
SPENCER J. HARRIS
No. HG 633
CERTIFIED HYDROGEOLOGIST
EXP 10/31/07
STATE OF CALIFORNIA

June 2006

CLEATH & ASSOCIATES
1390 Oceanaire Drive
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Wastewater influence on upper aquifer waters has historically been indicated by salt loading, including nitrate loading. Task 3 sampling also detected NDMA, sulfamethoxazole, and carbamazepine in water collected from multiple upper aquifer wells, which is interpreted to indicate wastewater influence. NDMA, a suspected carcinogen, was detected in water from the two wells that tap the shallowest upper aquifer zones (7Q1 and 13Q1), and was not reported in water from the deeper zones tested. Wells 7Q1 and 13Q1 also contained a greater level of salt loading. This is consistent with the assumption that the greatest wastewater influence would be expected at first water. The levels of NDMA detected in upper aquifer water were above the level at which customer notification is required, but below the response level at which source removal is recommended.

Sulfamethoxazole and carbamazepine are pharmaceuticals. The levels at which these compounds were detected are several orders of magnitude below human prescription levels, and they are indicators of wastewater influence. Concerns regarding the promotion of antimicrobial resistance for pathogenic microbial organisms has been expressed for increases in sulfanoamides (such as sulfamethoxazole) and other antimicrobial compounds in the environment. Carbamazepine, an anti-siezure drug, has been identified as a possible neuroteratogen, a compound that can affect neurological development in fetuses during pregnancy (Daughton, 2001).

A perspective on the PPCP and hormones/steroid results has been provided by Dr. John Vargo, the Environmental Health program manager for the University of Iowa Hygienic Laboratory where that portion of the Task 3 analyses were performed (Appendix D). Regarding the sulfamethoxazole and carbamazepine detections, Dr. Vargo writes, "Considering that these two chemicals are registered for use as human pharmaceuticals, it is unlikely they would present an adverse health risk at the levels they were detected." Dr. Vargo sums up his perspective as follows, "In my opinion, what has been found so far is not alarming but at the same time clearly indicates that some contamination of the water has occurred. Additional testing for other potential chemical contaminants should be considered if you have not already done so." Additional testing has been done, including the specific constituents listed by Dr. Vargo in his communication. Atrazine, carbon tetrachloride, 2,4-D, PCBs, and the polycyclic aromatic hydrocarbon benzo(a)pyrene were all tested for and not found. Task 3 has screened the upper aquifer for many potentially hazardous compounds, including suspected carcinogens (such as the volatile organic compounds) and endocrine disruptors (such as PCBs and pesticides).

With the exception of nitrate concentrations and iron and manganese concentrations locally, the constituents in upper aquifer ground water tested during Task 3 meet California State requirements for domestic use. Even after treatment for nitrate, iron and manganese removal or blending with lower aquifer water, however, use of the upper aquifer for a community drinking water supply is not without potential risks, based on the documented wastewater influence. The potential monitoring and treatment requirements for domestic use of upper aquifer water are not restricted to California Code of Regulations Title 22 constituents, but would include consideration of emerging contaminants such as NDMA, sulfamethoxazole and carbamazepine.

CONCLUSIONS

The following conclusions are based on the analytical results of Task 3 water quality characterization:

- Nitrate remains the primary regulated contaminant of concern in upper aquifer water, and is the only contaminant detected in excess of a primary (health-based) drinking water standards.

- With the exception of nitrate concentrations, and iron and manganese concentrations locally, the constituents in upper aquifer ground water tested during Task 3 meet California State requirements for domestic use. Color and turbidity concentrations measured in excess of secondary drinking water standards at one of the wells are interpreted to be related to inactive well facilities, and not the aquifer.

- Evidence of wastewater influence on upper aquifer water is not restricted to salt loading, and is indicated based on detections of NDMA and two PPCPs in multiple wells. NDMA was not reported in the deeper portions of the upper aquifer which are being considered for domestic use. The concentrations of NDMA in the top portion of the aquifer are above the consumer notification level, but below the response level at which discontinued use of the source is recommended by the State.

- Use of the upper aquifer for a community drinking water supply is not without potential risks, based on the documented wastewater influence. The monitoring and treatment requirements for domestic use of upper aquifer water may not be restricted to California Code of Regulations Title 22 constituents, but would include consideration of emerging contaminants such as NDMA, sulfamethoxazole and carbamazepine.

REFERENCES

Cleath & Associates, 2001, Drinking Water Source Assessment and Protection (DWSAP) program appendices for LOCSD wells, May 2001.

Cleath & Associates, 2005, Water Management Plan for the Los Osos Valley Ground Water Basin, July 2005 Draft.

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3/1/11 Bd Mtg. Item 5
Los Osos
Deadline: 2/22/11 by 12 noon

commentletters - 3/1/2011 BOARD MEETING

From: Edo McGowan <edo_mcgowan@hotmail.com>
To: <commentletters@waterboards.ca.gov>, <mkeeling@waterboards.ca.gov>, <edo...
Date: Monday, February 21, 2011 2:16 PM
Subject: 3/1/2011 BOARD MEETING
Attachments: antibiotic resistance.jpg; antibiotic resistance-SB.jpg

RECEIVED
FEB 22 2011
SWRCB EXECUTIVE

To: SWRCB & SLO RWQCB, Comments on Item #5 **3/1/2011 BOARD MEETING**

Re: Clerk to the Board at commentletters@waterboards.ca.gov. "**3/1/2011 BOARD MEETING**

DIVISION OF FINANCIAL ASSISTANCE

Item #5

Consideration of a proposed Resolution authorizing funding from the Clean Water State Revolving Fund (CWSRF) to the County of San Luis Obispo Los Osos Wastewater Project (Project), CWSRF Project No. C-06-5230.

The Project will offset potable water use in the Los Osos Groundwater Basin (Groundwater Basin) with California Title 22 disinfected, tertiary-treated recycled water. Recycled water will be **used for urban** and **agricultural irrigation** at sites that currently rely on potable water.

Comment: 1)The moneys allocated to this project should include testing for antibiotic resistant genes (ARGs) in the finished disinfected Title 22 recycled water. If this can not be done because the water is as yet unavailable, a surrogate test could be conducted on similar systems producing this water around the state for ARGs. Sewer plants that are proposed for preparation of recycled water must be capable of also removing CECs and ARGs from the finished product. This is currently not often the situation, thus: 3) Title 22 recycled water as typically produced represents a potentially cumulative and unnecessary adverse impact on human and environmental health.

This comment is is intended to be detailed so that the critical information information is available to the State and Regional Boards and their respective staff, thus allowing for a thoughtful development of policy and regulatory controls on the subject project. Antibiotic resistance is now a fact of life and thus it will be important for the boards and their staff to have some acquaintance with the subject. This is especially critical because the currently designed sewer plants generate the production of antibiotic resistant organisms which are then discharged in large numbers into the environment.

Fm: Dr Edo McGowan, Medical Geo-hydrology, Medical Hydropathology Working Group

The subject of antibiotic resistance, as discussed herein, is important for several reasons. Both human and veterinary medicine are expending considerable resources nationally in attempting to control the accelerating rates of antibiotic resistance. At the same time, resistance is rapidly destroying the remaining antimicrobial drugs that currently exist. To add insult to injury, the pharmaceutical industry seems disinterested in investing in new antimicrobials. Thus the tools available to medicine are diminishing. Concomitantly, the sewer plants, as currently designed and operated are releasing large volumes of antibiotic resistant microbes into the environment, thereby sabotaging the efforts of both human and veterinary medicine to control antibiotic resistance and consequently sewer plants and their byproducts are endangering public health and herd health.

That sewer plants as currently designed and operated do generate and discharge antibiotic resistant bacteria is beyond dispute. The Wastewater Research Division, Municipal Environmental Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio, conducted a protracted study on the ability of currently designed sewer plants to generate antibiotic resistant bacteria, which are then discharged. This US/EPA study was conducted in the late 1970s and reported in the early 1980s. The report based on the US/EPA study (1982) cited former studies reaching back another decade into the past and these cited studies said the same thing. Thus, although the information could hardly be considered as new, i.e., it has been around for nearly 4-decades, it seems not to have worked itself into the regulatory processes that control sewer plants. Since the State is **prime** for purposes of the Clean Water Act, it is time for the State and its Regional Boards to recognize this shortcoming, hence the need for the detail in this comment. Here is some extracted text from the report of the study conducted by the US/EPA:
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC241834/pdf/aem00183-0119.pdf

"Several researchers have pointed out that wastewater, treated or untreated, is a primary contributor of bacteria to the aquatic ecosystem (12, 16, 17, 20, 27, 29). Studies have been conducted which demonstrate that significant numbers of multiple drug-resistant coliforms occur in rivers (17), bays (9), bathing beaches (28), and coastal canals (13). Waters contaminated by bacteria capable of transferring drug resistance are of great concern since there is the potential

for transfer of antibiotic resistance to a pathogenic species.

When bacteria which carry transmissible R-factors (R+ bacteria) are ingested by a human host, the R-factors may transfer into commonly occurring bacteria of the gastrointestinal tract (32). These organisms may subsequently transfer this resistance to pathogenic organisms, resulting in reduced efficacy of antimicrobial chemotherapy in the event of an infection. In vivo studies have shown that when individuals carrying R+ bacteria are subjected to antibiotic therapy, py, these organisms flourish and transfer their resistance to other bacteria (25)."

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Project (No. C-06-5230)

The project (No. C-06-5230) discusses both municipal irrigation with recycled water and also the use of that water on agricultural lands. This comment will first discuss the use in agriculture. Following that will be a discussion on the use in municipal irrigation and accompanying human health issues. Additional attention should be accorded to the area of effluent discharge, i.e., the location and length of the outfall, the currents and tides and thus the ability for the outfalled sewage effluent to contaminate coastal areas and beach sands. To illustrate this effect, a separate note discussing the Montecito Sanitary District's outfall is attached at the end of this comment.

AGRICULTURE

It is necessary to discuss how irrigation with Title 22 recycled water may impact both the food produced, hence human health and also impact the underlying agricultural base that produces such food. It is well established that the food borne disease outbreaks in the Salinas Valley, through media attention, had badly crippled the area's income, even for farms not even connected with the problem. Nonetheless, the "problem" became a widespread economic disaster.

It is also well established that current water quality tests used by the State of California fail to reflect the actual presence of pathogens often found in the finished and disinfected Title 22 recycled water. This fact is amply demonstrated by the 2004 study by WERF (00-PUM-2T). The essence of that report's findings may be summed by the following sentence: "The failure of measurements of single indicator organism to correlate with pathogens suggests that public health is not adequately protected by simple monitoring schemes based on detection of a single indicator, particularly at the detection limits routinely employed."

This failure is also reflected by my work with finished disinfected Title 22 recycled water tested at two separate sewer districts, in which water we found multi-antibiotic resistant bacteria, see attachments which are photographs of disc diffusion tests of the recycled water showing the extent of the resistance. If you are unfamiliar with reading these test results, please do not hesitate to contact me for assistance. In the case of the finished Title 22 recycled water produced by the El Estero plant, the bacteria were resistant to 11 of the 12 challenge antibiotics. Water from the Goleta plant demonstrated resistance to 4 of the 12 test antibiotics. Unless there are some uncharacteristic factors related to these two plants that produce recycled water per state criteria that make them different from all other plants within the state, we should also find these results generally in most other plants that use these same criteria.

When this water is used to irrigate crops consumed raw, the bacteria and their genetic fragments can, through the consumption of the produce, be transferred to the human gut biota. These resistant bacteria and their genes are able to thus impact both the internal commensal (gut) biota and immune system.

Sjolund (2005) has found that once in the gut, the genetic material has a very long residence life, years. Additionally, once ingested, the plasmids may be transferred to and through normal flora into pathogenic bacteria found in humans or animals, making later treatment with particular antibiotics ineffective (US/EPA also noted this transfer). Additionally, one must consider that the transfer of genetic information from these organisms to more robust organisms might contribute to increased resistance in higher-grade pathogens by interspecies transfer. Sjolund et al go on to note that since populations of the normal biota are large, this affords the chance for multiple and different resistant variants to develop. This accordingly enhances the risk for spread to populations of pathogens. Consequently, by the use of sewage generated recycled water, as currently produced, there is a revolving door between the human population and the sewer plant, especially when foodstuffs are locally grown and consumed when raised on recycled water that is improperly treated.
What goes on food crops which are consumed raw can have long lasting effects. When humans defecate there is production of a fecal veneer around the anal skin. Thus the fecal veneer forming on the perineum would see colonization of adjoining orifices. There are recent studies on vaginal flora were females who had no contact with antibiotics were found with vaginal flora containing drug resistant bacteria. For the pregnant female, this may place the pregnancy at risk, especially if *Listeria monocytogenes* is found in water and soil. According to the Center of Disease Control (CDC), an estimated 2,500 persons become seriously ill each year with *Listeria monocytogenes* in the United States and among these, 500 will die. According to research, pregnant women account for 27% of these cases. CDC claims that pregnant women are 20 times more likely to become infected than non-pregnant healthy adults.
Vegetables can become contaminated from the soil, especially of the bacteria are brought in with the irrigation water. Such an inner connected series as irrigation with recycled water, contamination of crop, consumption of crop, transfer of resistance to gut, movement to fecal veneer, and establishment of resistant contamination in vaginal flora as described immediately above would provide but a single example for project No. C-06-5230, without adequate controls, to become a public health risk.

It is important to understand that there are two basic types of antibiotics with which medicine (human or veterinary) work: bacteriostatic and bacteriocidal. A good primer on this difference has been produced by the National Foundation for Infectious Disease and may be found at http://www.nfid.org/pdf/id_archive/antibiotictherapy.pdf.

Examples:

Bactericidal Drugs: Streptomycin, Sulfonamides, Aminoglycosides
Bacteriostatic Drugs: Tetracycline, Penicillin, Chloramphenicol

Many antibiotics are bacteriostatic and thus merely arrest the growth of bacteria but do not kill them, that job is left for the immune system. But if the immune system is also disrupted by, for example diabetes, and then hit with a chlorine-resistant bacteria, the job of quelling infections, hence the job of medicine, becomes far more complicated. The immune system is designed to produce a chlorine-like material used by the white blood cells to kill bacteria. But if these bacteria are chlorine resistant, this greatly challenges the immune system. If that immune system is already compromised: the very young, the very old, the diabetic, those on immune supressors, etc., the job of medicine is much increased.

Perhaps the case of methicillin resistant *Staphylococcus aureus* (MRSA) is an apt example. MRSA, out of all the various drug resistant pathogens, by itself, now kills more Americans than AIDS, this according to the CDC. Matt Wook Chang (see abstract below), in studying the response of bacteria to chlorine is finding that chlorine up-shifts the capacity of pathogens to cause disease by causing induction of major *virulence* genes. In working with methicillin resistant *Staphylococcus aureus* (MRSA), Chang finds that virulence genes are up-regulated by exposure to chlorine. This response is not limited to this one pathogen but is widely seen amongst bacteria. Dr Marlyn Roberts is finding MRSA along beaches and this issue of beach sands will be discussed later in this document. It is important to note, however, that beach sands offer an excellent medium for the growth and sustenance of pathogenic bacteria.

Thus although pathogens that might otherwise seldom meet in nature to exchange genetic information, upon entering sewer plants are finding themselves forced into close contact within these sewer plants with high levels of gene exchange and then exposed to chlorine. In this situation, the opportunities for development of both enhanced resistance and virulence are elevated. Because bacteria under stress can also enter a dormant state that is not visible to the standard tests, they are missed in the single indicator tests typically used in testing recycled water. This dormant state is called viable but non-culturable (VBNC). WERF has published on this dormant state and has shown that the standard tests used in wastewater and for wastewater byproducts may substantially under represent actual bacterial numbers **by several magnitudes**. Thus, in these conditions, which are common, the standard test results are giving false negatives and thus failing to serve their role in public health protection. We have noted this VBNC when we test finished Title 22 recycled water with the state approved MPN test. When we tested finished disinfected Title 22 recycled water just as it leaves the plant and again at the point of use we got dramatically different results. If we test just as the water is leaving the plant, we get non-detect or very low numbers with this standard testing procedure. When, however, we test this same water with the same test procedure at the point of use the numbers are often quite high and at times completely off the chart. We feel that this dramatic difference is related to resuscitation of bacteria in the VBNC state. It could also reflect the shedding of biofilms. Testing would help differentiate these two potentials. Personally, I think it is both and once the delivery system has an established biofilm that is shedding, the issue of public health is exacerbated. In using the disc diffusion tests as compared to the single indicator MPN test at both point of release and point of use, we get multi-antibiotic resistant bacteria. Thus the standard single indicator tests are not reflecting reality.

Some sewer plants producing recycled water are also using UV light as a disinfectant. There are flaws with this process that warrant some discussion. As noted in the 1982 report from the US/EPA study that demonstrated generation of antibiotic resistance by sewer plants, it will be noticed that UV not only enhanced antibiotic resistance but failed to kill up to 40% of certain

target bacteria. More recently in discussion with Dr. Amy Pruden who works with ARGs, it was mentioned that in close examination of UV disinfection results, although the bacteria were killed, the critical DNA that conferred resistance was not affected. If one were to review the 1928 work of Dr Fred Griffith, it will be found that live bacteria can extract genetic information from heat-killed bacteria.Thus merely killing bacteria with UV is insufficient for public health purposes.

This observation, the non destruction of DNA by UV, by Dr. Pruden is a significant finding because there is a strong reliance on UV in some systems. Dr. Pruden also notes that ARGs are unaffected by chlorine at levels typically used in water quality control and are so small that they will pass through typical filtering systems used by water treatment plants. Consequently, there is the opportunity to see ARGs and gene fragments, which are not amenable to the standard tests, making it through treatment works into the environment. Dr. Pruden is set up to test water samples for ARGs and it is suggested here that the State and thus its Regional Boards contact Dr Pruden to discuss testing of recycled water for ARGs. She may be reached through her university number at (540) 231-3980.

Antibiotic resistant genes that are common to reclaimed water are now also found in drinking water. The fact that sewer plants are generators of antibiotic resistant pathogens whose genes are generally easily taken up and multiplied by the gut biota is an area needing recognition by both the Stare and regional Boards and their respective staff. The ARGs, as I have previously noted, are so small that they pass through many types of filters normally used in water treatment and are not affected by chlorine levels typically used in water treatment. This fact then needs to be inculcated with standards and conditions for permitted uses. For example, if one were to examine the files at the SLO office for the plant in Monterey producing recycled water for the Salinas area, it might be noted that the filters (at least one) was being pushed at 150% of its rated capacity. This over-charge of the filter may well see ARGs moving through the system in large numbers. But based on current standardized tests, that would never be noted, even though the issue of ARGs and health are not disconnected.

The current standards also use proxy or surrogate tests to ascertain water quality. These proxy tests offer a template approach where the template is overlain on the system and if there is a fit, it is assumed that the water is safe. That template related to water clarity and coliform numbers is flawed. The Pomona virus study and its analysis discuss some of these surrogate tests related to water clarity and coliform numbers. In its discussion of this the State itself notes that there is no scientific basis for the reliance on this proxy test. Nonetheless, the regulatory community continues to allow the use of these tests. Much new scientific information has been brought forward since the Pomona study. Additionally, the stakes are now much higher because we are not only losing the battle with antibiotic resistant organisms, but the standards do not consider ARGs, thus there is a serious need to reappraise the tests which underlay the standards.

When we discuss the use of recycled water for irrigation of crops, it is important to understand that crops can internalize bacteria and thus no amount of washing at the kitchen sink has effect on such internalized bacteria. This internalization of bacteria was demonstrated in the 2002 Rutgers University study (see abstract below).

In the case of resistant bacteria and their genes, the bacteria can also interact with the soil commensal biota thus their containment within the soil in which the crops are grown becomes a reservoir for pathogens. This allows for a standing body of bacteria that can enter the roots, thus transferring to the edible portions. As shown by Chad Kinney (see abstract below) certain pharmaceuticals can accumulate in soils and these pharmaceuticals have been shown to be brought in with the recycled (reclaimed) water. The accumulation allows for two detractors, one is the eventual buildup of antibiotics like erythromycin to levels that may key off the development or maintenance of resistance and also, as CECs, may themselves be taken into the crop.

As currently designed and thus operated, many sewer plants can not effectively remove materials in solution. That this is a well documented fact may be seen by the pharmaceuticals now found in the water resources of this nation. There are ways around this with different available technology. That technology can be discussed in a different venue and I am pleased to do so.

A lot of food is now being irrigated with reclaimed sewer water. The State of California allows reclaimed water to be used on crops consumed raw. If this water were properly treated, that would not be a problem. Unfortunately, under current standards and the way sewer plants are designed and run, it can not be properly treated. Thus, leafy greens coming out of ag production areas may be highly suspect, this includes the certified organic. The abstracts below will give you some idea of this issue. Thus while the water may meet standards, it is by no means necessarily safe.

There are provisions in law which allow the Regional Boards to develop standards in areas not covered by current standards. Thus the discussions within this comment document are intended to provide an impetus toward the setting of corrective standards by the boards themselves where the CDPH has not entered the area and where there is a crying need for such standards.

My group is running tests on finished disinfected Title 22 recycled water and finding multi-antibiotic resistant bacteria in the finished product that goes on crops consumed raw. Additionally, as noted above, crops can internalize bacteria and thus no amount of washing at the kitchen sink has effect. Additionally, the plants can internalize pollutants, some of which will biomagnify, i.e., become concentrated within the plants. For example, if a field has too much organochlorine pesticide, one need only plant carrots to clean the soil. The carrots extract the pesticide and bioaccumulate it within the plant's tissues. This is the process called phytoremediation and it is a highly developed and scientifically validated process used globally. We did some of the initial work on developing this process when I was a grad student in the early 1970s at the Environmental Toxicology Department at UC Davis. We tested this with dieldrin and carrots.

Typical sewer plants do not do well with materials in solution and even RO has considerable difficulty in removing flame retardants and about 5% of these materials are found to move through RO. Additionally, certain antibiotics are also not removed by RO and there are recorded failure rates of 20%—this also assumes that these membranes are kept in pristine condition.

Interestingly, the systems that use reclaimed water for crop irrigation do not even go the the extent of using RO.

Chad Kinney, et al (2005) has demonstrated that soil irrigated with recycled water will accumulate pharmaceuticals. These then may biomagnify within the crop grown in that soil.

As to the biomagnification of endocrine disrupters in crops, this is again amply demonstrated in the literature. We do know that endocrine disrupters found in discharged wastewater can, and have, impacted several animal species, birds, fish, amphibians, and worms. Thus, there is potential but unknown impact on humans, especially as such would relate to fetal and first trimester development. Consequently by irrigating crops with recycled water with entrained endocrine mimics and antibiotic resistant microbes, including their genes, the public is being essentially put into a large unauthorized and potentially unethical human experiment.

The levels of endocrine mimics found in recycled water used to irrigate crops must be considered. Bacteria are not the only thing that may be taken into the plants and moved into the edible portions.

IRRIGATION OF MUNICIPAL GREENSCAPE

When this water is used to irrigate greenscape, many of the above discussed problems arise. The bacteria and their genetic fragments can, through the contact, reach the mouth and then enter the human gut biota, moving therefrom to body orifices. As we have seen above, these resistant bacteria and their genes are able to thus impact both the internal commensal (gut) biota and immune system.

Rusin and Gerba have published on finger to mouth transfer of pathogens, see abstracts below. With sprinkler irrigation of recycled water, the aerial transport to off-site surfaces happens and these contaminated surfaces (fomites) allow the transfer of pathogens to humans. There is a good body of literature on sprinkler generation of aerosols that can carry pathogens for considerable distances. The German government has established a set back of 300 meters between sprinklers and habitation. This is not now the case in California where sprinkler irrigation is just across the street from residential neighborhoods. Basum, see below, noted significant drift distances with sprinkler irrigation. This then becomes critical for irrigation around schools and thus on school playing fields where children with immature immune systems are present and have contact with fomites. I think it is not pushing the point to consider the transfer of resistant organisms to school children and then the liability issues that might arise from and to school districts for contamination.

CITATIONS

Sjolund et al. (2005) Emerging Infectious Diseases (Vol. 11, # 9, Sept 2005 @ p. 1389 et seq)

Sara Firl. **The Importance of Municipal Sewage Treatment in the Spread of Antibiotic Resistance**
106th General Meeting of the American Society for Microbiology
May 21-25, 2006, Orlando, Florida. (Session 041/Q, Paper Q-032)

Our study determined that substantial numbers of antibiotic-resistant bacteria were present in municipal wastewater, and that the existing treatment infrastructure did not adequately prevent release of antibiotic-resistant bacteria into the environment.

Validity of the Indicator Organism Paradigm for Pathogen Reduction in Reclaimed Water and Public Health Protection†

Valerie J. Harwood,[1*] Audrey D. Levine,[2] Troy M. Scott,[3] Vasanta Chivukula,[1] Jerzy Lukasik,[3] Samuel R. Farrah,[4] and Joan B. Rose[5]

The validity of using indicator organisms (total and fecal coliforms, enterococci, *Clostridium perfringens*, and F-specific coliphages) to predict the presence or absence of pathogens (infectious enteric viruses, *Cryptosporidium*, and *Giardia*) was tested at six wastewater reclamation facilities. Multiple samplings conducted at each facility over a 1-year period. Larger sample volumes for indicators (0.2 to 0.4 liters) and pathogens (30 to 100 liters) resulted in more sensitive detection limits than are typical of routine monitoring. Microorganisms were detected in disinfected effluent samples at the following frequencies: total coliforms, 63%; fecal coliforms, 27%; enterococci, 27%; *C. perfringens*, 61%; F-specific coliphages, ~40%; and enteric viruses, 31%. *Cryptosporidium* oocysts and *Giardia* cysts were detected in 70% and 80%, respectively, of reclaimed water samples. Viable *Cryptosporidium*, based on cell culture infectivity assays, was detected in 20% of the reclaimed water samples. No strong correlation was found for any indicator-pathogen combination. When data for all indicators were tested using discriminant analysis, the presence/absence patterns for *Giardia* cysts, *Cryptosporidium* oocysts, infectious *Cryptosporidium*, and infectious enteric viruses were predicted for over 71% of disinfected effluents. The failure of measurements of single indicator organism to correlate with pathogens suggests that public health is not adequately protected by simple monitoring schemes based on detection of a single indicator, particularly at the detection limits routinely employed. Monitoring a suite of indicator organisms in reclaimed effluent is more likely to be predictive of the presence of certain pathogens, and a need for additional pathogen monitoring in reclaimed water in order to protect public health is suggested by this study. (Applied and Environmental Microbiology, June 2005, p. 3163-3170, Vol. 71, No. 6)

Lettuce Plants Internalize Bacteria

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Lettuce that has been fertiziled with manure or irrigated with water that is contaminated with *E. coli* O157:H7 can take the bacteria up through its root system and internalize it inside its leaves, resisting traditional external sanitizing methods. Researchers from Rutgers University report their findings in the January 2002 issue of the journal *Applied and Environmental Microbiology*. "In recent years, *E. coli* O157:H7 has been isolated with increasing frequency from fresh produce, including bean sprouts, cantloupes, apples and leaf lettuce. The mechanisms by which the pathogen is introduced into the lettuce plant are not fully understood," say the researchers.

The researchers tested the hypotheses that the source of the contamination may be poorly treated manure (it is estimated that the pathogen is present in over 8 percent of dairy and beef cattle) or irrigation water that has been contaminated with cattle feces. The bacteria were isolated from plants grown using either medium, but interestingly, the researchers found bacteria in the inner tissues of the plants.

"We have demonstrated that lettuce grown in soil containing contaminated manure or irrigated with contaminated water results in contamination of the edible portion of the lettuce plant," say the researchers. "Moreover, the results suggest that edible portions of a plant can become contaminated without direct exposure to a pathogen but rather through transport of the pathogen into the plant by the root system. The inaccessibility of a large number of organisms, as a consequence of their subsurface location, is perhaps the reason for the lack of effectiveness of surface-sanitizing treatments." **(E.B. Solomon, S. Yaron, K.R. Matthews. 2002. Transmission of *Escherichia coli* O157:H7 from contaminated manure and irrigation water to lettuce plant tissue and its subsequent internalization. Applied and Environmental Microbiology, 68: 397-400.)**

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Wastewater Derived Pharmaceuticals In Soil Irrigated With Reclaimed Water

Environmental Toxicology and Chemistry

Article: pp. 317–326 | Abstract | PDF (143K)

PRESENCE AND DISTRIBUTION OF WASTEWATER-DERIVED PHARMACEUTICALS IN SOIL IRRIGATED WITH RECLAIMED WATER

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Three sites in the Front Range of Colorado, USA, were monitored from May through September 2003 to assess the presence and distribution of pharmaceuticals in soil irrigated with reclaimed water derived from urban wastewater. Soil cores were collected monthly, and 19 pharmaceuticals, all of which were detected during the present study, were measured in 5-cm increments of the 30-cm cores. Samples of reclaimed water were analyzed three times during the study to assess the input of pharmaceuticals. Samples collected before the onset of irrigation in 2003 contained numerous pharmaceuticals, likely resulting from the previous year's irrigation. Several of the selected pharmaceuticals increased in total soil concentration at one or more of the sites. The four most commonly detected pharmaceuticals were erythromycin, carbamazepine, fluoxetine, and diphenhydramine. Typical concentrations of the individual pharmaceuticals observed were low (0.02–15 μg/kg dry soil). The existence of subsurface maximum concentrations and detectable concentrations at the lowest sampled soil depth might indicate interactions of soil components with pharmaceuticals during leaching through the vadose zone. Nevertheless, the present study demonstrates that reclaimed-water irrigation results in soil pharmaceutical concentrations that vary through the irrigation season and that some compounds persist for months after irrigation.

Keywords: Pharmaceuticals, Wastewater, Reclaimed water, Soil, Leaching tendencies

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Viability of a low-pressure nanofilter in treating recycled water for water reuse applications: A pilot-scale study

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Abstract

The purpose of this study was to investigate the potential of a low-pressure nanofiltration (NF) membrane for treating recycled water for indirect potable water reuse applications. In particular, the tradeoffs in choosing low-pressure NF over reverse osmosis (RO) were investigated including whether or not significantly lowering operating pressures/costs would result in diminished permeate water quality. A NF membrane (Dow/Filmtec NF-4040) with high permeate productivity was selected for pilot-scale testing over a period of 1200 h at a water reuse facility employing conventional RO membranes for treating tertiary treated wastewater effluent prior to aquifer recharge. The novel application of an NF membrane in treating wastewater effluent for water reuse applications permitted a comprehensive screening of NF permeate water quality and allowed for the investigation of trace organic contaminant rejection on pilot scale with environmentally relevant feed water concentrations. Results from pilot-scale testing highlighted the selectivity of NF membranes in removing organic solutes present in wastewater effluents at the parts-per-trillion level. While operating pressures were by a factor of 2–3 lower than conventional RO membranes, and bulk and trace organic rejection generally exceeded 90 percent, not surprisingly, the rejection of monovalent ions such as nitrate was poor. The poor-to-moderate rejection of monovalent ions, however, resulted in lowered brine stream total dissolved solids concentration and sodium adsorption ratio as compared with the brine stream of conventional RO membranes, which may be beneficial for brine disposal strategies.

Toxicogenomic response to chlorination includes induction of major virulence genes in Staphylococcus aureus

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Abstract

Despite the widespread use of chlorination for microbial control in aqueous environments, cellular response mechanisms of human pathogens, such as Staphylococcus aureus, against chlorination remain unknown. In this work, genome-wide transcriptional analysis was performed to elucidate cellular response of S. aureusto hypochlorous acid, an active antimicrobial product of chlorination in aqueous solution. Our results suggest that hypochlorous acid repressed transcription of genes involved in cell wall synthesis, membrane transport, protein synthesis, and primary metabolism, while amino acid synthesis genes were induced. Furthermore, hypochlorous acid induced transcription of genes encoding major virulence factors of S. aureus, such as exotoxins, hemolysins, leukocidins, coagulases, and surface adhesion proteins, which all play essential roles in staphylococcal virulence. This work implies that chlorination may stimulate production of virulence factors, which provides new insight into host-pathogen interactions and effects of chlorine application for microbial control.

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J Appl Microbiol. 2002;93(4):585-92.

Comparative surface-to-hand and fingertip-to-mouth transfer efficiency of gram-positive bacteria, gram-negative bacteria, and phage.

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Abstract

AIMS: To determine the transfer efficiency of micro-organisms from fomites to hands and the subsequent transfer from the fingertip to the lip.
METHODS AND RESULTS: Volunteers hands were sampled after the normal usage of fomites seeded with a pooled culture of a Gram-positive bacterium (Micrococcus luteus), a Gram-negative bacterium (Serratia rubidea) and phage PRD-1 (Period A). Activities included wringing out a dishcloth/sponge, turning on/off a kitchen faucet, cutting up a carrot, making hamburger patties, holding a phone receiver, and removing laundry from the washing machine. Transfer efficiencies were 38.47% to 65.80% and 27.59% to 40.03% for the phone receiver and faucet, respectively. Transfer efficiencies from porous fomites were <0.01%. In most cases, M.luteus was transferred most efficiently, followed by phage PRD-1 and S. rubidea. When the volunteers' fingertips were inoculated with the pooled organisms and held to the lip area (Period B), transfer rates of 40.99%, 33.97%, and 33.90% occurred with M. luteus, S. rubidea, and PRD-1, respectively.
CONCLUSIONS: The highest bacteral transfer rates from fomites to the hands were seen with the hard, non-porous surfaces. Even with low transfer rates, the numbers of bacteria transferred to the hands were still high (up to 10(6) cells). Transfer of bacteria from the fingertip to the lip is similar to that observed from hard surfaces to hands.
SIGNIFICANCE AND IMPACT OF THE STUDY: Infectious doses of pathogens may be transferred to the mouth after handling an everyday contaminated household object.

Significance of Fomites in the Spread of Respiratory and Enteric Viral Disease▽

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Worldwide annually there are 1.7 million deaths from diarrheal diseases and 1.5 million deaths from respiratory infections (56). Viruses cause an estimated 60% of human infections, and most common illnesses are produced by respiratory and enteric viruses (7, 49). Unlike bacterial disease, viral illness cannot be resolved with the use of antibiotics. Prevention and management of viral disease heavily relies upon vaccines and antiviral medications (49). Both vaccines and antiviral medications are only 60% effective (39, 49). Additionally, to date there are no vaccines or antiviral drugs for most common enteric and respiratory viruses with the exception of influenza virus and hepatitis A virus (HAV). Consequently, viral disease spread is most effectively deterred by preclusion of viral infection.
Increases in population growth and mobility have enhanced pathogen transmission and intensified the difficulty of interrupting disease spread (14). Control of viral disease spread requires a clear understanding of how viruses are transmitted in the environment (27). For centuries it was assumed that infectious diseases were spread primarily by the airborne route or through direct patient contact, and the surrounding environment played little or no role in disease transmission (19, 27). Up until 1987 the Centers for Disease Control and the American Hospital Association focused on patient diagnosis due to the belief that nosocomial infections were not related to microbial contamination of surfaces (19). Over the years studies have changed the perspective on viral transmission to include a more complex multifactorial model of disease spread (27). There is now growing evidence that contaminated fomites or surfaces play a key role in the spread of viral infections (3, 7, 38, 71).
Viral transmission is dependent on interaction with the host as well as interaction with the environment (60). Viruses are probably the most common cause of infectious disease acquired indoors (7, 71). The rapid spread of viral disease in crowded indoor establishments, including schools, day care facilities, nursing homes, business offices, and hospitals, consistently facilitates disease morbidity and mortality (71). Yet, fundamental knowledge concerning the role of surfaces and objects in viral disease transmission is lacking, and further investigation is needed (52, 60, 61). The goal of this article was to use existing published literature to assess the significance of fomites in the transmission of viral disease by clarifying the role of fomites in the spread of common pathogenic respiratory and enteric viruses.

Comparison of Coliphage and Bacterial Aerosols at a Wastewater Spray Irrigation Site

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Received 24 April 1981/Accepted 22 September 1981
Microbiological aerosols were measured on a spray irrigation site at Fort Huachuca, Ariz. Indigenous bacteria and tracer bacteriophage were sampled from sprays of chlorinated and unchlorinated secondary-treatment wastewaters during day and night periods. Aerosol dispersal and downwind migration were determined. Bacterial and coliphage f2 aerosols were sampled by using Andersen viable type stacked-sieve and high-volume electrostatic precipitator samplers.

Bacterial standard plate counts averaged 2.4 x 105 colony-forming units per ml in unchlorinated effluents. Bacterial aerosols reached 500 bacteria per m3 at 152 m downwind and 10,500 bacteria per m3 at 46 m. Seeded coliphage f2 averaged 4.0 x lo, plaque-forming units per ml in the effluent and were detected 563 m downwind. Downwind microbial aerosol levels were somewhat enhanced by nighttime conditions. The median aerodynamic particle size of the microbial aerosols was approximately 5.0 p.m. Chlorination reduced wastewater bacterial levels 99.97% and reduced aerosol concentrations to near background levels; coliphage f2 was reduced only 95.4% in the chlorinated effluent and was readily measured 137 m downwind. Microbiological source strength and meteorological data were used in conjunction with a dispersion model to generate mathematical predictions of aerosol strength at various sampler locations. The mean calculated survival of aerosolized bacteria (standard plate count) in the range 46 to 76 m downwind was 5.2%, and that of coliphage f2 was 4.3%.

THE FOLLOWING IS PRESENTED TO DEMONSTRATE THAT OUTFALL PLACEMENT MAY HAVE A PROFOUND IMPACT ON BEACH CONTAMINATION.

Wastewater Research Division, Municipal Environmental Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio.

Several researchers have pointed out that wastewater, treated or untreated, is a primary contributor of bacteria to the aquatic ecosystem (12, 16, 17, 20, 27, 29). Studies have been conducted which demonstrate that significant numbers of multiple drug-resistant coliforms occur in rivers (17), bays (9), bathing beaches (28), and coastal canals (13). Waters contaminated by bacteria capable of transferring drug resistance are of great concern since there is the potential for transfer of antibiotic resistance to a pathogenic species.

McGowan's abstract.....

Short and shallow marine sewer outfalls, a connection with the spread of antibiotic resistance?

Of the 49 sewer outfalls along the California coast, 17 could be considered as short and shallow which may increase marine and beach sand contamination with antibiotic resistant pathogens. Public beaches adjacent to these short shallow outfalls (SSO) may become reservoirs of antibiotic resistance. Studies of beach sand in lake and marine systems have demonstrated contamination with a variety of pathogens. Some studies specifically considered antibiotic resistant Staphylococcus aureus (MRSA) which now kills more Americans than AIDS, according to the CDC.

Beach-goers who dug in the sand or covered themselves with sand were, in the following week or two, more likely to have diarrheal illnesses from a variety of organisms.

Beach sand, especially if it contains ground kelp, offers a good medium for the regrowth and maintenance of pathogens. Do SSO's augment the contamination of coastal beaches and are the bacteria likely to contain antibiotic resistant genetic material? An answer may be gained by tracking effluent released from SSO's. Pilot data indicate effluent may be returned to the beach and near shore waters.

Sewer plants are a principal source for the generation and release of antibiotic resistant bacteria and their genetic material, per peer reviewed published facts for approximately 40 years. US/EPA also published on the topic in 1982. The California Department of Public Health and the Regional Water Quality Control Boards do not recognize this potentially dangerous situation and consequently have generated no standards for its control.

CDC, US/EPA and IATFAR currently plan no research on the subject.

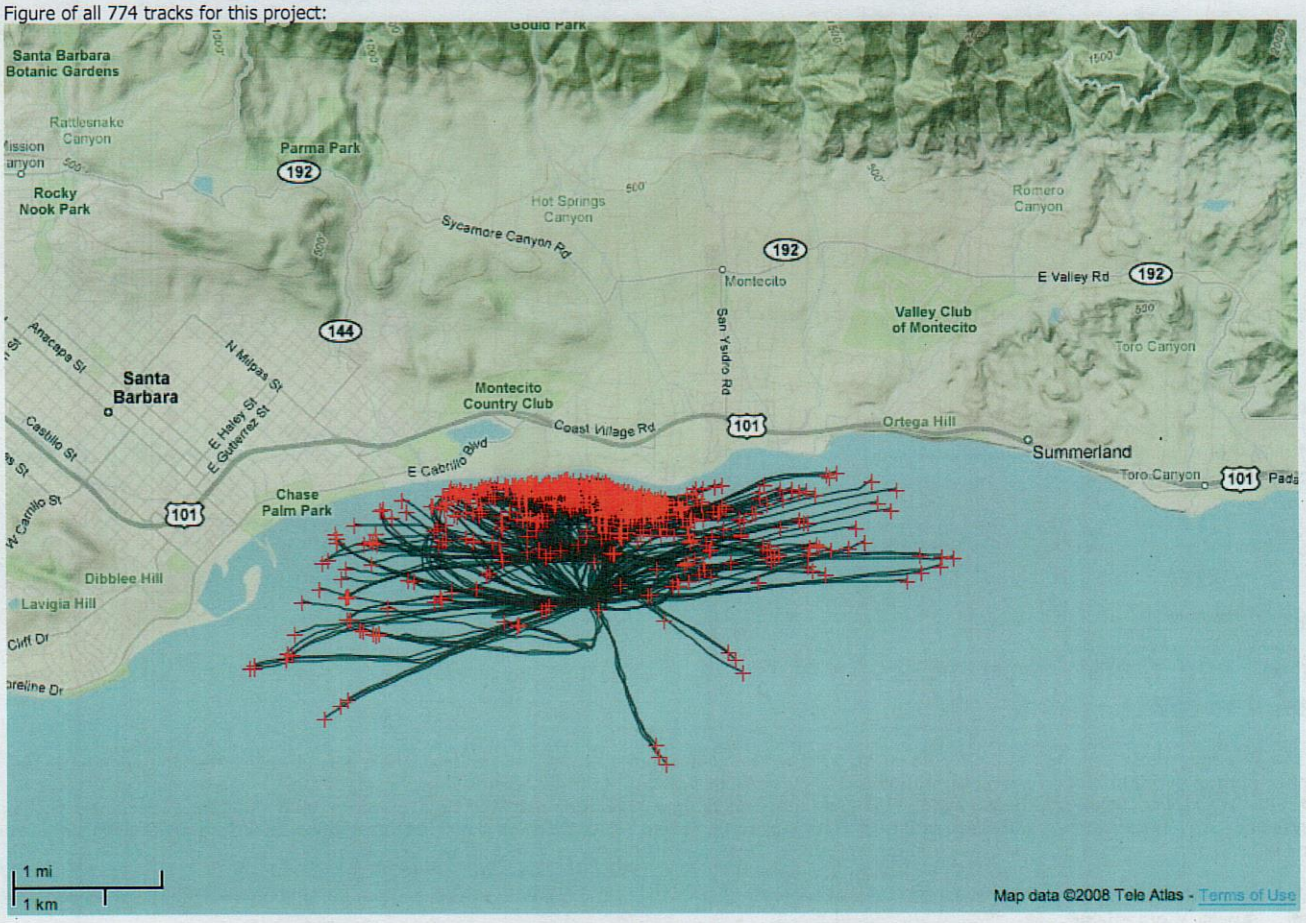
Table of California sewer outfalls which discharge less than ½ mile from shore and depth of less than 40 feet

POTW/WWTP .....Miles from shore..... Depth in feet

Anchor Bay 0.00 0
Shelter Cove 0.00 0
Fort Bragg 0.12 20
Crescent City 0.13 10
Eureka 0.00 0
Arcata 0.00 0
Half Moon Bay 0.36 37

Daly City	0.47	32
Ragged Pt Inn	0.00	0
Summerland	0.14	20
San Simeon	0.17	20
Avela Beach	0.42	29
Montecito	0.29	35
Carmel Area	0.11	35
Carpinteria	0.19	25
San Clemente Ils	0.00	0
Terminal Ils	0.17	32
Mendecino	0.19	60
Avalon	0.08	130

Figure of all 774 tracks for this project:



Trackers released at the subsurface discharge point of Montecito Sanitary District's sewer outfall showing movement back to beach area and stacking at beach-front. Using these data allows one to argue that released pathogens in the sewage effluent would follow tracker routes. Outfall is 0.29 miles from shore and at a depth of 35 feet. Black lines represent vector of tracker and red + is where tracker stopped its movement.

6 Environmental Impacts Analysis

6.1 Approach and Methods to this Assessment

The State Water Board has prepared this substitute environmental document to assess the potential environmental effects of adopting and implementing the proposed Policy for regulating wastewater discharges from onsite wastewater treatment systems. In general, the Policy will operate to protect the environment by ensuring that discharges from onsite wastewater treatment systems occur in a manner that does not pollute groundwater or surface water. However, there are potential environmental impacts associated with aspects of the proposed Policy.

The potential environmental impacts were identified and then reviewed for applicability and significance. Applicability was determined by assessing whether the impact would likely occur in each tier based on activities taken to comply with the proposed Policy. A description of each tier in the proposed Policy is provided in section 3.3.

Environmental impacts are the same for multiple tiers in several cases, while others are unique to a tier. If it was determined that activity within a tier would cause the identified impact, the significance of the impact was then assessed. This is particularly true in the case of Tier 2 where counties may deviate from Tier 1 in the proposed Policy and in the case when regional water boards may adopt or retain more protective requirements in their basin plans than the requirements of the proposed Policy. Where, due to variation in the Tier 2 program at the local level or due to variation from the difference between the proposed Policy and the incorporation of the proposed Policy with additional more protective standards in the regional water board basin plans, impacts are identified, those impacts are discussed and assessed with proposed mitigation, where necessary.

In this case, environmental impacts as a result from complying with the proposed Policy are no different from impacts that are reasonably foreseen as a result of the project itself. The proposed Policy allows OWTS to be operated and, in some cases (e.g. failing OWTS), will require that OWTS be repaired, constructed and replaced in a particular manner. The resulting discharges allowed by the proposed Policy, the resulting construction activities, and other environmental impacts are associated with complying with the proposed Policy.

In order to more accurately describe what the means of compliance are as a result of the proposed Policy, we have included a short description here as well as a more detailed description with expected costs in section 8 of the SED.

<u>Implementation by local and state agencies</u>: Local agencies and the state water boards and regional water boards are required to perform specific tasks for implementing of this proposed project. The State Water Board is the agency that adopts and maintains the proposed Policy, approves basin plans incorporating the proposed Policy, and resolves disputes between the regional boards, the local agencies, and the public. The regional boards are required by the proposed Policy to incorporate the proposed Policy into their basin plans, negotiate an agreement for implementation with the local agencies desiring to implement Tier 2, and oversee implementation of large OWTS, OWT that are subject to specific requirements in areas with impaired waters, any other OWTS that are outside

reasons, that this mitigation measure is infeasible and cannot be implemented, the impact associated with nitrogen contamination from operation of OWTS would be **Significant and Unavoidable.**

6.2.6 Direct Impacts from Contamination of Other Constituents of Concern from Operation of OWTS Statewide

There are many constituents of concern in domestic wastewater, including OWTS effluent that could contribute to degradation of water quality if discharged into the OWTS in lieu of disposing using other means. Researchers have evaluated a wide range of contaminants associated with domestic wastewater over the years. Constituents of particular concern are those that might contaminate surface water or groundwater.

Any such contamination could directly or indirectly affect beneficial uses of the waters. Contaminants included in this group are trace minerals and phosphorus, metals, salts, organic compounds and a group of compounds known as endocrine disrupting compounds. A brief summary of health concerns related to these contaminants follows.

Phosphorus. Phosphorus is an aquatic plant nutrient that can also contribute to eutrophication (algal blooms) of inland and coastal surface waters and reduction of dissolved oxygen. In contrast to some forms of nitrogen, phosphorus is not directly toxic to humans, but has been shown to be involved in several water quality problems related to eutrophication that can affect human or animal health. Examples include the formation of carcinogenic trihalomethanes during the chlorination of waters that have recently experienced algal blooms (Kotak *et al.* 1994); consumption by livestock or humans of waters containing cyanobacteria blooms or the neuro- and hepatotoxins released when these blooms die (Martin and Cooke 1994); and, most recently, the effect on human health of neurotoxins and other toxic constituents released by dinoflagellates, such as *Pfiesteria piscicida*, that bloom in phosphorus-limited eutrophic coastal waters (Burkholder and Glasgow 1997).

Metals. Some metals in drinking water may cause human health problems. Metals including lead, mercury, cadmium, copper, and chromium can cause physical and mental developmental delays, kidney disease, gastrointestinal illnesses, and neurological problems (DeWalle *et al.* 1985). In the aquatic ecosystem, they are also toxic to aquatic life and accumulate in fish and shellfish that might be consumed by humans. Metals can be present in raw household wastewater from commonly used household products; aging interior plumbing systems that can contribute lead, cadmium, and copper; foodstuffs; and human waste (USEPA 2002).

Several USEPA priority pollutant metals have been found in domestic septic tank effluent (including nickel, lead, copper, zinc, barium, and chromium), although at low concentrations. Copper and zinc were the only trace metals found in any significant amounts, and those concentrations were less than in tap water (Whelan and Titmanis 1982). Reviews and studies to date, although not extensive, have suggested there is very little need for concern over heavy metals in domestic septic tank effluent (Siegrist *et al.* 2000). The fate of metals in soil is varied and depends on complex physical, chemical, and biochemical interactions. Although studies appear to indicate possible removal in

both the septic tank and soils, some risk remains, and groundwater contamination in specific cases, although unlikely, is possible (USEPA 2002).

The primary processes controlling the fixation or mobility of metals in subsurface infiltration systems are adsorption onto negatively charged soil particles and interaction with organic molecules. The solubility of metals is pH dependent and tends to be lowest between pH 6 and 8. Acidic conditions can reduce the sorption of metals in soils, leading to increased solubility and therefore increased risk of groundwater contamination (Evanko and D Zombak 1997, USEPA 2002).

Salts. Increases in dietary salt in humans via water or foods are associated with an increase in heart disease, but the levels of concern and effects are still under debate.

Chloride and sulfide cause taste and odor problems in drinking water. Sodium and to a lesser extent potassium can be deleterious to soil structure and OWTS dispersal system performance, although normal or conservative residential uses of salts and household bleaches are not detrimental to the microbial population (Bounds 1997). Sodium is commonly present in background levels in groundwater. However, the sodium concentration is considerably higher in discharges from an OWTS when the OWTS receives discharge from water softeners. Concentrations of boron and calcium in septic tank effluent typically reflect those found in the water supply source. Major natural sources of sulfate in drinking water are from oxidation of metallic sulfide compounds (such as FeS) found in bedrock. Domestic wastewater contains additional sulfate concentrations from the oxidation of reduced sulfur compounds present in fecal matter. Higher concentrations of sulfate in OWTS effluent typically are from the source water in the domestic supply (domestic well water or municipal water) as part of the natural water quality of the region. In general, dissolved inorganic compounds may affect the soil structure and function, which may subsequently reduce the effectiveness of the soil to treat OWTS effluent before it reaches groundwater.

Organic Compounds. Organic compounds are present in many routine household chemicals, cleaning products and solvents, and components of pharmaceuticals and personal care products that include prescription and nonprescription drugs and caffeine. Potential negative health effects from ingesting water containing these compounds include neurological and developmental problems, and cancer. In addition, concentrations of these chemicals in wastewater may affect some functions of both conventional and supplemental treatment systems, causing indirect effects such as a reduction in treatment of specific pollutants. The primary pathways of exposure to humans would be through ingestion of drinking water contaminated by organic chemicals, direct contact with water, such as bathing or swimming, and respiration of droplets from bathing or other aerosols.

Organic compounds can be present in groundwater and surface water from anthropogenic pollution sources. This type of pollution, once present, can be very difficult to remove. Some of these pollutants accumulate and concentrate in ecosystem food chains. Commonly used surfactants (or foaming agents) are linear alkylbenzene sulfonate (LAS), alcohol ethoxylate (AE), and alcohol ether sulfate (AES). They are readily removed via biodegradation in septic systems or sorption onto soils, even under worst-case conditions

(Nielsen *et al*. 2002). As an example of persistence in the environment, Gamma-BHC, commonly called Lindane, is an isomer (one of several chemical forms) of the chemical hexachlorocyclohexane (HCH) and is used as an insecticide on fruit, vegetables, and forest crops. It is also used as a lotion, cream, or shampoo to treat head and body lice and scabies. It is banned in many, but not all countries and remains legal for use in the United States. Lindane has not been produced in the United States since 1976 but continues to be imported for insecticide use (ATSDR 2004).

Surfactants, or foaming agents, are commonly used in laundry detergents and other soaps to decrease the surface tension of water and increase wetting and emulsification. Surfactants are the largest class of human-produced organic compounds present in raw domestic wastewater. They can be found in most domestic septic system effluents (Wisconsin Department of Commerce 1998, USEPA 2002). Surfactant molecules contain both strongly hydrophobic (not easily mixing with water) and strongly hydrophilic (easily mixing with water) properties and thus tend to concentrate at interfaces where water meets air, oily material, and particles.

Hinkle *et al*. (2005) found nine organic wastewater compounds in more than 90% of groundwater samples from a monitoring network down gradient of OWTS dispersal system effluent:

- acetyl-hexamethyl-tetrahydro-naphthalene (AHTN)
- caffeine
- cholesterol
- hexahydrohexamethyl-cyclopentabenzopyran
- N,N-diethyl-meta-toluamide (DEET)
- tetrachloroethene
- tris (2-chloroethyl) phosphate
- tris (dichloroisopropyl) phosphate
- tributyl phosphate

Detection of these compounds provides evidence that some of them may be useful indicators of human waste effluent dispersal in some hydrologic environments. Studies have shown mixed results regarding removal of organic compounds using conventional OWTS. Reductions depend on the chemical type and a multitude of environmental factors. Although several studies found complete or nearly complete removal of organic compounds below OWTS (USEPA 2002; Ayres Associates 1993a, 1993b; Robertson 1991; Sauer and Tyler 1991), other studies found variable results in the potential for such chemicals to reach and flow with groundwater (USEPA 2002). Studies have indicated that the common LAS, AE, and AES surfactants are readily removed from groundwater in soils below the soil dispersal fields, even in situations with minimal unsaturated soil zones. The most successful processes for removing these surfactants are likely biodegradation and sorption (USEPA 2002, Nielsen *et al*. 2002). Surfactants do not usually create public health concerns, although methylene blue active substances, common in household laundry detergent, can affect the aesthetic quality of water if present in significant quantities by inducing foaming. No investigations have been found that identify cationic or nonionic surfactants in groundwater that originated from soil

dispersal fields (WI DOC 1998, USEPA 2002). However, with the unpredictability of removal, groundwater contamination must be assumed to be taking place in some specific cases.

Endocrine-Disrupting Compounds. The presence of common hormones, drugs, and chemicals from personal care products (e.g., shampoo, cleaning products, and pharmaceutical products) in wastewater and receiving water bodies is an emerging water quality and public health concern. Endocrine-disrupting compounds (EDCs) are substances that alter the function of the endocrine system (secretions, such as hormones, distributed through the body by way of the bloodstream) and consequently cause adverse health effects on exposed organisms or their offspring. EDCs may be present in such common items as medicines, over-the-counter therapeutics, pesticides, soaps, shampoos, hair colors, plastics and plasticizers, polychlorinated biphenyls (PCBs), spermicides, preservatives, and specific metals. Only recently has the presence of EDCs been detected in water bodies of the United States at a high frequency; however, measured concentrations have been low and usually below drinking water standards (in the cases of those compounds for which standards have been established). Specific studies have found EDCs in water bodies in sufficient quantity that they could potentially cause endocrine disruption in some fish. The extent of human health risks and dose responses to EDCs in concentrations at the low levels found in the environment are still unknown. The specific category of EDCs includes both natural compounds, such as phytoestrogens, and synthetic chemicals, which are of increased concern. Congress has directed EPA to study the transmission of EDCs through drinking water. Some EDCs have been implicated in accelerating the growth of breast cancer cell cultures, thereby raising questions about other human health effects (Felsot 1994, MacMahon 1994, Safe 1995).

These effects were seen at concentrations measured in parts per trillion, levels at which most chemicals have never been tested. Other than the product-intended oral or dermal uses, exposure routes, after transmission to an OWTS, include ingestion of contaminated drinking water or foodstuffs, bathing or swimming in contaminated water, and possible respiratory contact.

Although some of the contaminants identified in Section 303(d) as contributing to impairment of water bodies in California are categorized as EDCs, EDCs as a category are not currently regulated as water quality contaminants in federal or state water quality objectives. EPA is currently studying the transmission pathways and effects of EDCs and although some scientific studies have investigated their effects on human health, these compounds are not currently regulated or classified as contaminants or pollutants by any federal, state, or local public health agency. If additional information becomes available indicating that EDCs pose a risk to human health and/or the environment, this issue may merit further consideration by public health agencies and the State Water Board.

All of the substances presently identified as hormone disruptors are now widely distributed throughout the environment. Some are common constituents of consumer products, and many are now found in human tissues and have been shown to affect the health, reproduction, and behavior of animals.

Although hormone-related diseases have not been clearly linked to environmental chemicals, it is probable that endocrine disruptors are contributing to human diseases and dysfunction (Ankley *et al*. 1997). The EPA, through the 1996 reauthorization of the Safe Drinking Water Act, was directed to address the issue of possible endocrine disruptors in drinking water. The White House convened an interagency task force of national experts to improve the national response to the issue and evaluate consumer exposures, workplace exposures, and facility releases of chemicals (Ankley *et al*. 1997).

These "endocrine disruptors" include both natural compounds and synthetic chemicals. Some, called phytoestrogens, occur naturally in a variety of plants. Living things have evolved with these natural substances and have mechanisms to metabolize or degrade them so they do not bioaccumulate. Of current concern are the synthetic estrogens produced either through industrial manufacture or as byproducts of such processes or burning. Some of these have been found to speed the growth of cultures of breast cancer cells, raising questions about human health effects (Felsot 1994, MacMahon 1994, and Safe 1995). The effects have been detected at chemical concentrations of parts per trillion, levels at which most chemicals have never been tested.

Diseases that are associated with general environmental exposure to toxic pollutants or other environmental contaminants are not well reported and the causes are difficult to pinpoint, even at some of the more infamous sites of exposure, such as the Love Canal in New York or other hazardous waste sites where high levels of contaminants can be found. At very low levels, such as those found in OWTS effluent or in foods, the risks are measured in terms of a lifetime of chronic exposure. No data are available that can be used to relate any type of OWTS-effluent related exposure to any occupational or consumer-related exposure to chemicals that could be meaningfully interpreted. Further investigation would require expenditure and work effort that is beyond the requirements of CEQA. **No conclusion can be made at this time.**

No Mitigation is Required.

6.2.7 Indirect Impacts related to the Relaxation of Existing Local Regulations

The policy requires that the regional water boards incorporate the requirements established in the Policy by amending their basin plans within 12 months of the effective date of this Policy, pursuant to Water Code Section 13291(e). In so doing, the regional water boards are required to consider whether it is necessary and appropriate to retain or adopt any more protective standards. To the extent that a regional water board determines that it is necessary and appropriate to retain or adopt any more protective standards, they need to reconcile those region-specific standards with the policy to the extent feasible, and shall provide a detailed basis for its determination that each of the more protective standards are necessary and appropriate. The State Water Board ultimately determines adequacy of the standards included in the basin plans, including the basis for any more protective standards. Therefore, the standards could potentially be relaxed due to non-inclusion or non-adoption at the regional water board level or because of non-adoption of those more restrictive standards at the State Water Board. However,

San Luis Obispo County
Los Osos Wastewater Project Development

TECHNICAL MEMORANDUM

IMPORTED WATER

FINAL DRAFT
March 2008

2700 YGNACIO VALLEY ROAD • SUITE 300 • WALNUT CREEK, CALIFORNIA 94598 • (925) 932-1710 • FAX (925) 930-0208

this time that AWWA PVC pipe would be appropriate for this transmission pipeline. Applying a unit cost estimate of $110/LF[9] and a 30 percent contingency, the cost of 11 miles of 8-inch diameter C900 PVC pipe Class 150 is $8.3 million. Trenching, backfill, compaction, and "T" Top trench repair (paving 1 foot outside the trench on either side) are all included in the per linear foot pipe cost.

These are construction cost estimates only, and do not include permitting costs, CEQA costs, design costs and other project implementation costs. The estimate includes a contingency of 30 percent.

4.2.4.2 Cost of Treatment Plant

Assuming that Los Osos builds its own treatment plant to treat Nacimiento water, and assuming a treatment plant of size 2 mgd (1.0 mgd average day, 2.0 mgd maximum day), and a planning level treatment plant cost of $4/gpd, the construction cost of the treatment plant is estimated to be $8.0 million. These are construction cost estimates only, and do not include permitting costs, CEQA costs, design costs and other project implementation costs. The estimate includes a contingency of 30 percent. An alternative could be that the raw Nacimiento water gets treated at the City of San Luis Obispo and then piped to Los Osos. In this case, costs would need to be negotiated with the City of San Luis Obispo. A second alternative could be that the water would be treated at upgraded CMC facilities and piped down the Chorro Valley pipeline.

4.2.5 Contractual Issues with Connecting to Nacimiento Water

The City of San Luis Obispo has contracted for the amount of Nacimiento Water that it needs for buildout, so the scope of negotiations to purchase some of the City's allocation of Nacimiento water might be limited at present. Also, since the participants of the Nacimiento project are obliged to pay for the full contractually agreed amount irrespective of actual demand, it is anticipated that the City of San Luis Obispo is going to use its maximum Nacimiento allotment before using other sources.

An alternative Nacimiento delivery configuration for Los Osos would be similar to that of CSA 10, by negotiating an exchange of Nacimiento contract water with the Whale Rock supply. However, the City of San Luis Obispo optimizes its water supply by applying its "conjunctive use model" which uses the flexibility of many sources to maximize supply. It also has a "multi-source water policy" which improves the reliability of its water supply by diversifying its sources. Thus any agreement which hampered the diversity of its sources, by making the City give up its use of another source (such as Whale Rock Reservoir) could defeat the purpose of having a new diversified supply in the first place. [10]

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[9] Engineer's estimate made in 2007 for Potable Water Distribution System Upgrade for Department of Corrections and Rehabilitation, California Men's Colony, San Luis Obispo.

[10] As per telephone conversations with San Luis Obispo County Public Works staff, and the Water Division Manager of the City of San Luis Obispo.

A supplemental EIR would need to be prepared for Los Osos to receive Nacimiento water, and it would require that at least 55 percent of participating agencies agree to the proposed project. Thus participating in the Nacimiento project could prove to be a lengthy and complicated process requiring a negotiation with several parties. In addition, it would require Los Osos to get into the water treatment plant operations business.

5.0 SUMMARY

Imported water is anticipated to offset potable water demand from the groundwater basin. Consideration of State water or Nacimiento water would require a complete environmental review by the water purveyors as per the California Environmental Quality Act (CEQA). This technical memorandum summarizes the evaluation of imported water as an option for mitigating sea water intrusion (SWI) in the Los Osos groundwater basin. Imported water does not forgo the need for wastewater disposal. Therefore, to evaluate the total cost to the community for wastewater disposal and SWI mitigation, any imported water option would be paired up with a disposal option for comparison to other alternatives. The reuse projects that provide a fair comparison to imported water are those that provide seawater intrusion mitigation benefits similar to importing water by offsetting pumping on the West side of the basin. These comparable options include urban reuse and agricultural exchange (using recycled water for agricultural demand and transporting potable water from the East side to the West side, thereby offsetting pumping from the West side of the basin).

Both alternatives of importing water will involve a lengthy negotiation process that would take a considerable amount of time and effort from all involved parties. Both options would require additional facilities to be built, although Nacimiento could require a longer pipeline, and a treatment plant as compared with State water.

A cost comparison of the two alternatives is shown in Table 3. Note that these are construction cost estimates only, and do not include all contingencies, permitting costs, CEQA costs, design costs and other project implementation costs.

Notwithstanding the institutional and cost barriers to an expedient solution, public sentiment also plays a large role in the decision making process. Development could potentially be fueled by importing water into rural lands. These issues should be addressed as part of the EIR.

California Regional Water Quality Control Board
Central Coast Region

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Matthew Rodriquez
Secretary for Environmental Protection

Edmund G. Brown Jr.
Governor

MEMORANDUM

TO: Central Coast Regional Water Quality Control Board

FROM: David LaCaro – Environmental Scientist

DATE: December 9, 2011

UPDATE ON THE LOS OSOS GROUNDWATER BASIN ISJ WORKING GROUP'S ACTIVITIES, SAN LUIS OBISPO COUNTY

Background

Domestic water for the Los Osos community is produced by three main water purveyors, Golden State Water Company (GSWC), Los Osos Community Services District (LOCSD), and S and T Mutual Water Company (S&T). To resolve a formal complaint that was filed in San Luis Obispo County Superior Court by the LOCSD, the three main water purveyors and San Luis Obispo County entered into an Interlocutory Stipulated Judgment (ISJ) on August 5, 2008. The ISJ allows for the parties to cooperatively assess, develop, and implement a plan to address water rights and use in the Los Osos Basin. The County's participation in the ISJ Working Group allows coordinated efforts between the construction of the wastewater project and water management in Los Osos.

2010 Los Osos Groundwater Basin Update

The ISJ Working Group notified the public of their efforts through the May 5, 2010 Los Osos Groundwater Basin Plan Update. The update included a discussion of various ISJ Working Group activities that will be investigated and considered to balance the Los Osos groundwater basin. The basin is currently not in balance; pumping withdrawals exceed the safe yield of parts of the basin's aquifers, leading to seawater intrusion. Central Coast Water Board staff wrote a memorandum on July 23, 2010, which described the ISJ Working Group's activities in detail. The memorandum can be found at the following link.

http://www.swrcb.ca.gov/centralcoast/water_issues/hot_topics/2010_07_23_ISJ_workinggroup_memo.pdf.pdf

2011 ISJ Working Group Status Update

On October 6, 2011, Rob Miller (LOCSD contract engineer and ISJ Working Group representative) provided a status update on the ISJ Working Group's current activities (funding, draft basin plan development) and an overview of the April 2011 draft conservation evaluation (Maddaus Report) at a LOCSD meeting. The October 6, 2011 LOCSD meeting agenda, staff report, and minutes can be found at the following link.

http://www.losososcsd.org/cm/board/AgendaandMinutes/Board%20Meeting%20Agendas%20and%20Minutes.html

ISJ Working Group Goals

The ISJ Working Group established goals that guide the group's decision-making process. These goals include writing a comprehensive Los Osos Basin Plan (Basin Plan), coordinating and aligning efforts with the County's Los Osos Wastewater Project, developing concrete actions to address seawater intrusion, implementing the Los Osos Basin Plan with built-in flexibility based on new information, and reinstituting the quarterly groundwater monitoring and reporting program to track groundwater quality as activities are being implemented. At this time, some elements of the draft Basin Plan are far along. However, the ISJ Working Group is working on resolving some remaining elements of the Basin Plan. . The ISJ Working Group will release the draft Basin Plan for public review and comment. Although a specific release date has not been provided, the ISJ Working Group says it is working diligently to release it as soon as possible.

Current Activities

Water Conservation Activities – The ISJ Working Group's water conservation measures currently in progress include the County's Retrofit-Upon-Sale Program and the New Development Offset Program, which have already converted several hundred fixtures in the community; installation of water meters in the S&T service area, which should serve to reduce lower aquifer pumping in their service area; purveyor-specific rebate programs where purveyors provide a discount for the replacement of old fixtures with low flow fixtures; and implementation of the water conservation program, which will begin in spring of 2012. These programs are designed to decrease water use through retrofit programs and increase awareness of water use within the community. Similarly, the County is developing its own water conservation plan associated with the permitting of the wastewater project pursuant to the California Coastal Commission Coastal Development Permit.

Basin Plan Delineation – The ISJ Working Group developed various maps that delineate the boundary of the basin. The map includes water purveyor service areas, rural residential parcels within the Basin Plan area served by individual/private wells, delineated open space areas, and agricultural parcels. Parcels identified within the Basin Plan area will be subject to ordinances and actions to manage groundwater that are adopted as part of the Basin Plan.

Groundwater Basin Modeling – The ISJ Working Group has developed multiple iterations of groundwater modeling. Each modeling scenario includes variations of well production (i.e., upper to lower aquifers and pumping areas located east to west). The goal of the groundwater models was to establish an approximate safe pumping yield rate. A safety factor of 10 to 20 percent, based on uncertainties of each groundwater model, was used in determining the theoretical safe pumping yield. If the estimated safe pumping yield is maintained, the ISJ Working Group anticipates that the seawater intrusion wedge in the upper zone of the lower aquifer (Zone D) will recede in a westerly direction. The safety factors and modeled safe pumping yields will be incorporated in to the draft Basin Plan for public vetting.

Increasing Upper Aquifer Production – The ISJ Working Group is currently pursuing activities that will maximize production in the upper aquifer. As an example, the LOCSD recently applied for Proposition 84 grant funds (through the state Department of Public Health) to establish an upper aquifer nitrate removal facility at the new South Bay upper aquifer well, using ion exchange. As part of this effort, construction bidding documents have been prepared with the intent of advancing the project quickly in the event grant funds are secured. The ISJ Working Group is also considering a centralized nitrate removal project, which will likely be described at a programmatic level in the first draft of the Basin Plan. Currently, the conceptual centralized nitrate facility has not been funded or designed.

The ISJ Working Group also recognizes that recent technical information indicates that the upper aquifer can safely yield more water, from a quantity basis, as opposed to a quality basis. As such, the LOCSD is currently maximizing production from its South Bay lower aquifer well (Dave: but doesn't that increase overpumping from the lower aquifer?) with the intent of lowering nitrate to a level appropriate for blending with its new upper aquifer well.

GSWC is also pursuing increased production from the upper aquifer through the implementation of the Rosina well blending project. This funded project includes the construction of a pipeline from the upper aquifer Skyline Well to the lower aquifer Rosina Well for the purpose of blending. GSWC is currently pursuing a coastal development permit for the project through San Luis Obispo County.

Minimizing Westerly Pumping Activities – Both the LOCSD and GSWC continue to utilize easterly production facilities to the extent practical, including maximizing production at the GSWC South Bay Well and LOCSD's South Bay lower aquifer well. More pumping in the east reduces pumping on the westerly front, which leads to less immediate pressure reductions in the west, for interim seawater intrusion relief. GSWC recently placed its deep aquifer Pecho Well, which is located within the westerly portion of the basin, on standby status with Department Of Public Health. It will only be used for emergency purposes. The focus of current infrastructure projects is on increasing upper aquifer production as described above.

Maddaus Report – On April 5, 2011, the ISJ Working Group publicly released the draft 2011 Water Demand Analysis and Water Conservation Evaluation (Maddaus Report). The purpose of the Maddaus Report was to analyze various water conservation options for future funding and implementation. The report focused on five main conservation goals: 1) forecast future water demand under various water conservation scenarios, 2) estimate conservation costs and related water savings, 3) analyze individual conservation measures, 4) group conservation measures into defined programs, and 5) assess effectiveness of programs to meet the indoor use goal of 50 gallons per person per day. The report analyzed 31 conservation measures and specifically evaluated the water savings, associated costs, and cost-to-benefit ratios. Furthermore, the report identified five water conservation programs, which contained different combinations of the 31 different water conservation measures based on associated costs, water savings, and overall benefit. The report concluded that three programs did not meet the goal of 50 gallon per capita per day. However, the report recommended that a combination of elements from the other two programs might be implemented as both programs provide a favorable cost-to-benefit comparison and will meet the water saving goal of 50 gallons per capita per day. The selected water conservation program will have to align with the County's water conservation program pursuant to the coastal development permit, which will ultimately be approved by the California Coastal Commission.

Future Activities

ISJ Working Group Input in the County's Urban Reuse Program – Many areas identified for urban reuse (e.g., schools, community park, cemetery) as part of the greater Los Osos Wastewater Project are customers of GSWC and LOCSD. The GSWC and LOCSD will have input in the County's Urban Reuse program in order to ensure that the reuse program aligns with the draft Basin Plan. Furthermore, the ISJ Working Group will provide input regarding dual-plumbing for subdivisions, new development, and other areas where feasible.

Comprehensive Groundwater Monitoring – The ISJ Working Group proposes to reinstitute groundwater monitoring for the three aquifer layers (e.g., perched or first

water, upper, and lower). The ISJ Working Group is currently developing a groundwater monitoring plan that will be incorporated into the draft Basin Plan. The comprehensive groundwater monitoring program will be consistent with the Central Coast Water Board's Monitoring and Reporting Program (MRP) for the County's Wastewater Project, which will begin prior to the wastewater facility's start-up

County Basin-Wide Special Tax – The County may consider establishing a specific tax for all basin users. This will provide a consistent funding source for projects associated with the management of the basin (i.e., new production wells, conservation activities, nitrate removal activities) to meet current and future demands. However, the County has not formally proposed a special tax at this time.

Anticipated Legal Activities – The ISJ Working Group anticipates that once the draft Basin Plan and associated legal boundary is complete, a "watermaster" will be established to manage the basin. The ISJ Technical Group could perform this function. A framework will be established to share operations and funding of future production facilities (i.e., nitrate removal facilities, interties, etc.) and to seek opportunities to involve users (i.e., agriculture parcels and private well owners) outside of the purveyors' service areas, such as basin-wide ordinances for water use.

Concluding Observation

The Los Osos groundwater basin has been damaged by 1) wastewater from septic tanks causing nitrate degradation and contamination, and 2) excessive pumping of the lower aquifer with resultant seawater intrusion. The nitrate problem has caused purveyors to curtail shallow well use in recent years. This shallow aquifer abandonment has led to increased deeper pumping which has greatly exacerbated seawater intrusion. Both nitrate and seawater render water undrinkable without expensive treatment or blending. This lack of wastewater and pumping management is proving costly to the community. The County is proceeding with improved wastewater management to deal with the nitrate problem (and other wastewater caused problems), and the ISJ working group is working on overall basin management including managed pumping. All participants are working on conservation to reduce the demand, which will reduce the difficulty of pumping management. With reduced demand, nitrate control, and pumping management, the groundwater basin can be brought back into balance to repel seawater intrusion.

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LOS OSOS GROUNDWATER BASIN UPDATE
ISJ Working Group
May 4, 2010

The ISJ Working Group is working under the auspices of the Interlocutory Stipulated Judgment in the Los Osos Groundwater Basin (Basin) adjudication to draft and implement a Basin Management Plan (BMP). The BMP is in draft form and we expect will be released during 2010. This update discusses the basic elements of the BMP, updated information generated by recent groundwater investigations in the Basin, and various mitigation measures that are being evaluated to remedy water resource challenges facing the Basin.

I. LOS OSOS GROUNDWATER BASIN MANAGEMENT PLAN

The BMP is being created through collaborative participation of members of the ISJ Working Group. The BMP describes the Basin, its hydrologic and geologic settings, community water demands and groundwater quality. The BMP also acknowledges the major challenges facing the Basin, i.e., water quality in the upper aquifer and seawater intrusion in the lower aquifer.

The BMP is designed to memorialize the ongoing and future water monitoring processes, groundwater management goals for the Basin and to outline the mechanisms and processes by which those goals will be achieved. The anticipated goals include the following:

(A) Provide for a continuously updated hydrologic assessment of the Basin, its water resources and safe yield;
(B) Establish a strategy for maximizing the reasonable and beneficial use of Basin water resources;
(C) Provide sustainable water supplies for existing and planned future development within Los Osos;
(D) Stop seawater intrusion into the lower aquifer;
(E) Manage existing contamination and prevent future contamination of the upper aquifer;
(F) Protect environmentally sensitive areas within or influenced by the Basin hydrology;
(G) Quantify each party's rights to rely on the Basin water resources;
(H) Allocate costs equitably;
(I) Develop strategies to maximize the grant funding opportunities for ongoing BMP implementation; and
(J) Set water conservation goals.

The BMP describes in detail the actions that will be taken in order to implement these goals. These actions include determination of Basin water supply and demand, establishment of a groundwater monitoring program, and an operations and recharge plan for the Basin, which will provide for management of salts and nutrients in the groundwater. These actions will be coordinated with the actions to be taken by the County as part of the Los Osos Wastewater Project (LOWWP).

II. BACKGROUND

A. Groundwater Zones

The Basin contains roughly five layers of groundwater, which have been identified, from shallowest to deepest, as Zones A, B, C, D and E. Not all zones are present in all areas of the Basin. Zone A is comprised of Los Osos Creek bed alluvium. Zone B contains perched groundwater. Zones A & B are depicted in Exhibit A. Zones A & B are not generally used for groundwater production and are effectively isolated hydraulically from the underlying aquifers (Zones C, D & E) by an extensive clay layer. Zones C, D and E are the sources of groundwater production from the Basin. Zone C represents the upper aquifer, which suffers from nitrate pollution caused by septic systems. Zone D and Zone E together make up the lower aquifer, which is threatened by seawater intrusion.

B. Safe Yield

Safe yield is generally defined as the maximum draft on a basin that will not produce undesirable impacts. In the LOCSD Draft Water Management Plan produced in 2005, the Basin safe yield under then-current conditions was listed at 3,250 acre-feet per year (AFY), of which 800 AFY was for the Los Osos Creek Valley[1] and 2,450 AFY was for the urban area.

The steady-state groundwater model that has been developed primarily by Cleath + Harris, Inc. on behalf of the ISJ Working Group was updated in 2004, was converted to simulate seawater intrusion in 2005, and in 2008 was updated again to reflect current pumping conditions. The primary constraint on safe yield of the Basin is seawater intrusion. In 2009, the safe yield estimate was updated using the groundwater model. Under current conditions (assuming no Los Osos Creek Valley surplus water development), the overall basin yield estimate is 3,200 AFY. After subtracting 1,100 AFY in agricultural irrigation, private domestic use and golf course irrigation, the purveyors have available for their use an estimated 2,100 AFY of sustainable safe yield. This is comparable to the current level of community demand which has averaged approximately 2,040 AFY over the period from 2004-2008.[2]

Balancing the Basin without supplemental water requires a redistribution of pumping between the upper (Zone C) and lower (Zones D & E) aquifers. In other words, the safe yield analysis has clarified that more pumping should be done from the upper aquifer (Zone C), and less pumping from the lower aquifer (Zones D and E) in order to achieve sustainable safe yield from

[1] The Los Osos Creek Valley, also known as the Creek Compartment, extends from the Eastside (defined below), across the Los Osos Creek Valley to the east limits of the basin.

[2] It should be noted that these figures are estimates based on the existing Basin model, and the ISJ parties will develop the BMP to include a reasonable buffer to account for the uncertainty that exists in every groundwater basin model.

the Basin. In addition, it may be necessary for pumping to shift from the Westside[3] to the Eastside[4] and the Los Osos Creek Valley.

In terms of safe yield by aquifer layer, for a balanced Basin under current conditions the upper aquifer (Zone C) yield is 1,700 AFY (assuming existing nitrate contamination is either removed or adequately treated) and the lower aquifer (Zones D and E) yield is 1,500 AFY. The distribution of upper aquifer versus lower aquifer yield varies across the Basin, however, with most of the lower aquifer yield in the Eastside and Los Osos Creek Valley. After subtracting water production allocated to agricultural irrigation, private domestic use and golf course irrigation, the safe yield distribution for water purveyors is 1,460 AFY from Zone C and 640 AFY from Zones D and E.

C. Seawater Intrusion

As is commonly known, the Basin is experiencing increasing levels of seawater intrusion into the lower aquifer (Zones D and E). Between 1985 and 2005, the average annual rate of intrusion in lower aquifer Zone D was estimated at 60 feet per year for the 250 milligram per liter (mg/l) isochlor line and 45 feet per year for the 2,500 mg/l isochlor line. During this same period, the rate of intrusion for precursor trends (early-detection at lower chloride concentration based on ion ratios) at approximately 200 feet per year between GSWC wells Pecho (13L4) and Rosina (13J4), and approximately 600 feet per year between GSWC Rosina and the LOCSD Palisades well (18L2).

Seawater intrusion monitoring was conducted in December 2009 and January 2010 to update estimates of the rate and extent of seawater intrusion in lower aquifer Zones D and E and to assist in planning, implementing and evaluating sea water intrusion mitigation measures. Results of the current monitoring event, which followed three years of drought conditions, indicate that: the seawater wedge has extended into the lower aquifer through “fingers” as well as a broader front; the average horizontal rate of intrusion between 2005 and 2010, based on the 250 mg/l isochlor, has accelerated to 700 feet per year; and the 250 mg/l isochlor line has reached the LOCSD Palisades well (18L2). The results of the monitoring are reported in the Technical Memorandum from Cleath + Harris, Inc., attached as Exhibit B.

D. Peer Review

The ISJ Working Group and the County have used the groundwater model referenced above to evaluate the safe yield of the Basin and the impact of actions to be undertaken as part of the BMP and LOWWP on the health of the Basin. In order to ensure that the model results are reasonably accurate for its purposes, the ISJ Working Group hired Stetson Engineers, Inc. to perform a peer review of the model. A memorandum describing the results of that peer review is attached as Exhibit C. The key findings are that:

[3] The Westside of the basin extends west of Palisades Avenue and includes Cuesta-by-the-Sea, Redfield Woods, the Martin Tract, Cabrillo Estates, Sunset Terrace and Monarch Grove.

[4] The Eastside of the basin extends east of Palisades Avenue and includes Baywood, downtown Los Osos, Bayview Heights, Bayridge Estates, mobile home parks on Los Osos Valley Road and all rural residential neighborhoods between South Bay Boulevard and Palomino Drive.

- While there is uncertainty in all models, the SEAWAT model developed by Cleath-Harris Geologists and recent model results appear reasonable.

- SEAWAT is an appropriate model code for the Los Osos basin for evaluation of the average groundwater basin budget (including basin and subarea yields), the extent of seawater intrusion, and for use in evaluating the relative effects of development and changes in basin management or climate.

- The current SEAWAT model and results regarding seawater intrusion and safe yield provide usable results on which to base near-term changes in pumping distribution to mitigate seawater intrusion.

The various recommendations for improvements to the model made by Stetson Engineers, Inc. in the memorandum will be addressed as part of development of the BMP.

III. GROUNDWATER MANAGEMENT ACTIONS

Based on the increasing rate of seawater intrusion described above, it is clear that quick and decisive action must be taken to address the intrusion. Specific actions that are being considered are described below.

A. LOWWP Actions

In order to mitigate the effects of increased seawater intrusion from the removal of septic tank disposal, and to use the tertiary treated wastewater effluent to assist in ensuring a safe and reliable supply of water for the Basin into the future, the County of San Luis Obispo is currently planning to take the following actions as part of the LOWWP, subject to final approval of a Coastal Development Permit by the California Coastal Commission and adoption of a final due-diligence resolution by the County.

1. ***Broderson Disposal.*** Pursuant to Condition 97 of the Coastal Development Permit for the LOWWP, the project will dispose of tertiary treated effluent at the Broderson site, up to approximately 448 AFY.

2. ***Bayridge Leach Field.*** Pursuant to Condition 101, the project will dispose of approximately 33 AFY at the site of the existing Bayridge leach field.

3. ***Indoor Water Conservation.*** Pursuant to Conditions 1, 99, 103 and 108, the project (in consultation with the water purveyors) will implement an indoor water conservation program within the prohibition zone allowing for 50 gallons per capita per day indoor water use.

4. ***Agricultural Reuse.*** Pursuant to Condition 97, the County will apply treated effluent to agricultural re-use overlying the Basin.

5. ***Urban Reuse of Treated Wastewater Effluent.*** Pursuant to Condition 97, the County will apply treated effluent to urban re-use (as identified in the Effluent Re-Use and Disposal Tech Memo, July 2008).

The ISJ Working Group recognizes the above-listed LOWWP actions are crucial to mitigating the negative impacts with which the Los Osos community is faced and that implementation of these measures should be pursued as soon as possible. The group believes these measures are complementary to the additional actions being considered by the ISJ Working Group, which are described below.

B. BMP Actions

The following actions are not being pursued as part of the LOWWP, but the ISJ Working Group is investigating these actions further and considering them as part of the BMP as means of balancing the Basin. The ISJ Working Group is committed to presenting the ISJ parties with a BMP that includes sufficient actions to balance lower aquifer water supplies and demands and stop the progress of seawater intrusion. Potential actions under investigation include the following:

1. ***Relocation of Wells.*** This action would shift the location of a certain amount of groundwater production by LOCSD, GSWC and S&T from the Westside to the Eastside or the Los Osos Creek Valley. Implementation of this action may require the drilling of new groundwater production wells and transmission mains. This action may be integrated with the agricultural reuse described as a LOWWP action above.

2. ***Water Conservation.*** In addition to the indoor water conservation measures being taken under the LOWWP, there may be opportunities to reduce urban water demands in Los Osos based on indoor water conservation outside the prohibition zone and outdoor water conservation throughout the Basin area, primarily through changing landscape types and irrigation methods. For example, commercial and residential irrigation can be automated based on specific plant needs and weather and soil conditions.

3. ***Nitrate Removal from Zone C.*** This action would require the use of well-head treatment facilities to remove nitrates to achieve 1, 400 AFY of safe yield from Zone C.

4. ***Use of Shallow Wells.*** There may be opportunities to reduce pumping from Zones C, D and E by using shallow wells from Zones A and B for irrigation.

5. ***Brackish Water Desalination.*** This action would produce groundwater from areas of Zones D and E that have been affected by seawater intrusion and treat it through a desalination process for municipal use. Strategic location of brackish groundwater production wells may assist in preventing seawater intrusion into new areas of the Basin.

6. ***Rainwater Harvesting*.** This action would involve working with local property owners to collect rainwater for use on site.

7. ***Installation of Greywater Systems*.** This action would involve working with local property owners to install greywater systems, by which certain types of wastewater are treated and reused on site.

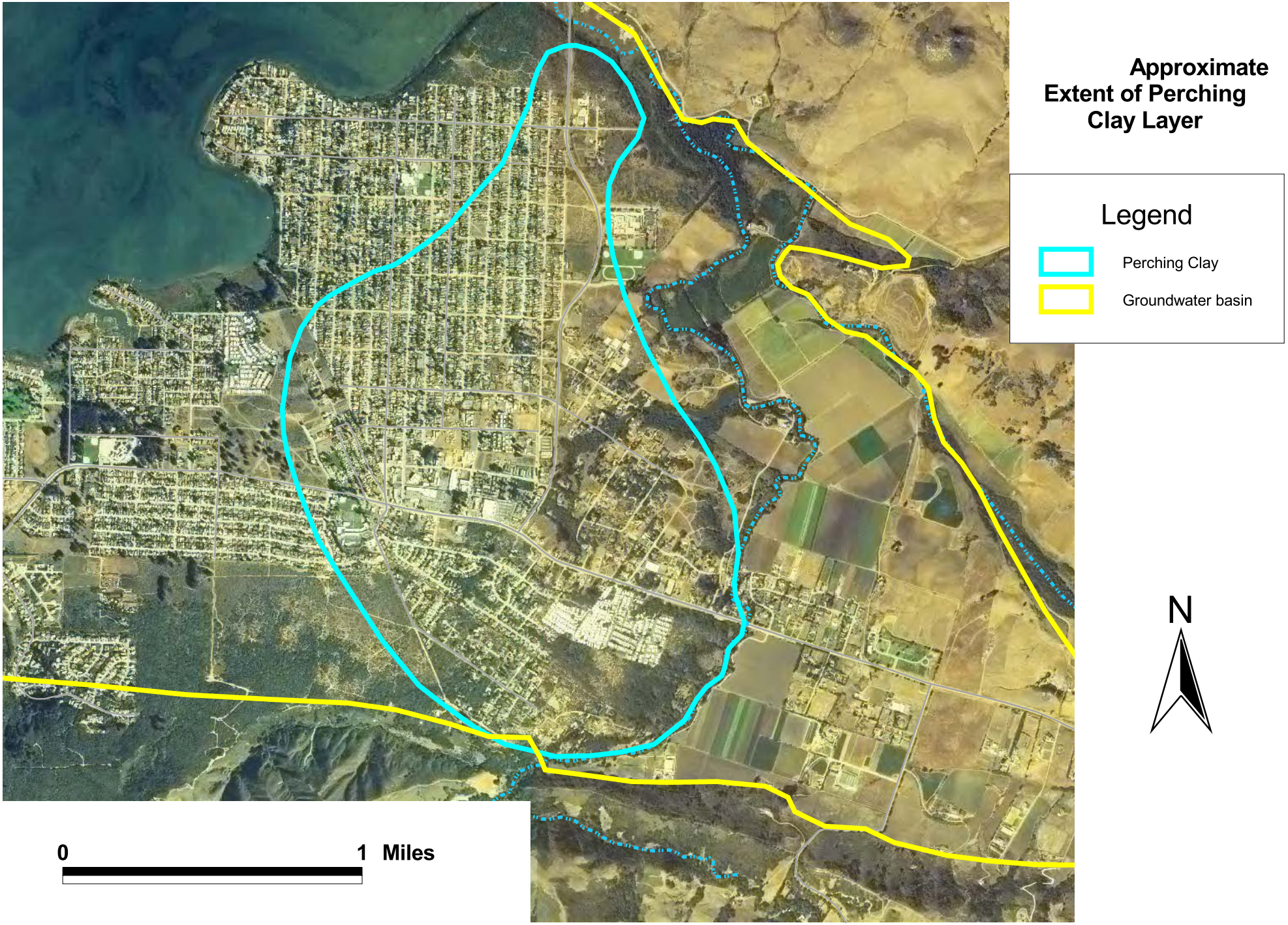
Many of these actions would involve leadership or participation by the water purveyors, as well as residents and businesses within the Los Osos community.

IV. NEXT STEPS

The ISJ Working Group is currently studying the actions above and intends to prepare a public review draft of the BMP by the end of 2010. The BMP will include a financing strategy and timeline for implementation of adopted actions.

SB 542232 v6:006774.0151

EXHIBIT "A"


Approximate Extent of Perching Clay Layer
Legend
Perching Clay
Groundwater basin
N
0
1 Miles

Cleath-Harris Geologists, Inc.
11545 Los Osos Valley Road, Suite C-3
San Luis Obispo, California 93405
(805) 543-1413

Technical Memorandum

PROFESSIONAL GEOLOGIST
SPENCER J. HARRIS
No. HG 633
CERTIFIED HYDROGEOLOGIST
EXP. 10/31/11
STATE OF CALIFORNIA

Date: April 26, 2010
From: Spencer Harris
To: Los Osos ISJ Group

SUBJECT: Water Quality Monitoring Results Summary, November 2009 - January 2010, Los Osos Valley Groundwater Basin.

Water quality monitoring in the Los Osos Valley groundwater basin was conducted between November 2009 and January 2010. The purpose of monitoring is to update estimates concerning the rate and extent of sea water intrusion in the lower aquifer and to assist in planning, implementing, and evaluating sea water intrusion mitigation measures. The analytical results of groundwater samples collected from basin wells are presented in the attached Table 1.

Between 1985 and 2005, the average annual rate of intrusion in lower aquifer Zone D was estimated at 60 feet per year for the 250 milligram per liter (mg/l) isochlor line and 45 feet per year for the 2,500 mg/l isochlor line. These were the average annual rates estimated over the time period. Data from the 2005 study also showed the rate of intrusion for precursor trends (early-detection at lower chloride concentrations based on ion ratios) at approximately 200 feet per year between Golden State Water Company (GSWC) wells Pecho (13L4) and Rosina (13J4), and approximately 600 feet per year between GSWC Rosina and the Los Osos Community Services District (LOCSD) Palisades well (18L2).

Rates of sea water intrusion are affected primarily by water levels (pressure gradients), and aquifer permeability. The rate of intrusion is typically not uniform over time, but varies seasonally according to pumping cycles, and is accelerated during drought periods. Intrusion may also not be uniform within the aquifer zones, but may follow preferential pathways along discrete sand and gravel layers being tapped by pumping wells.

Results of the current monitoring event, which followed three years of drought conditions, indicate the average horizontal rate of intrusion between 2005 and 2010, based on the 250 mg/l isochlor, has accelerated to match the earlier precursor rates (up to approximately 700 feet per year), and has reached the LOCSD Palisades well (18L2). Evidence of accelerated seawater intrusion since 2005 has also been confirmed with geophysics at a deep monitoring well (13M1), where there has been a vertical rise in the seawater interface of 25 feet since the 2005 survey. By comparison, the sea water interface rose 30 feet at Well 13M1 between 1985 and 2005. The estimated location of the transition zone at the base of aquifer Zone D (250 mg/l isochlor) is shown in plan view in the attached Figure 1, with a cross-section of the transition zone movement in Zones D and E shown in Figure 2. An illustration showing the upward movement of sea water intrusion at monitoring well 13M1 is shown in Figure 3.

EXHIBIT "B"

Table 1
Water Quality Results - Sea Water Intrusion Monitoring
Los Osos ISJ Group

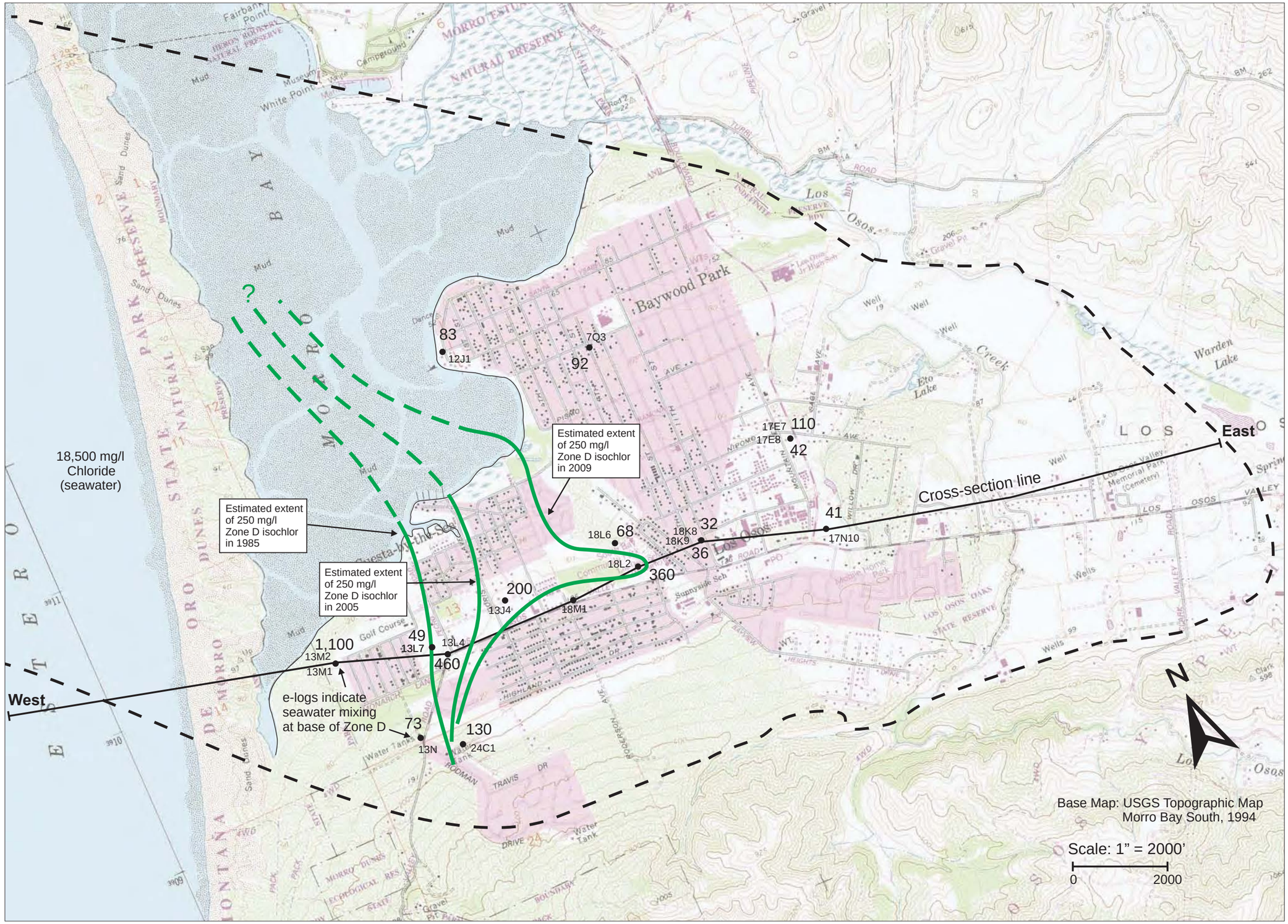
Station ID	Well Name	Sample Date	HCO3	Hardness	Cond	pH	TDS	Cl	NO3	SO4	Ca	Mg	K	Na
			mg/l	mg/l	mg/l		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
30S/10E-12J1	MBO5 DWR Obs.	11/20/2009	300	360	1150	7.5	732	83	ND	190	51	58	4.4	95
30S/10E-13J4	GSWC Rosina	1/14/2010	35	260	778	6	435	200	7.1	13	41	38	1.5	33
30S/10E-13L4	GSWC Pecho	11/20/2009	85	550	1610	7	979	460	10	48	91	78	2.1	69
30S/10E-13L7*	S&T #4	11/19/2009	60	110	410	6.9	270	49	59	14	18	15	1.4	38
30S/10E-13M2	Howard East	12/9/2009	55	1100	3740	7.1	2170	1100	2.2	220	160	160	4.8	370
30S/10E-13N	S&T #5	11/19/2009	41	89	386	6.8	267	73	27	11	15	13	1.4	38
30S/10E-24C1	GSWC Cabrillo	11/20/2009	60	150	611	7.1	347	130	18	22	23	22	1.6	52
30S/11E-7Q3	LOCSD 8th St.	11/19/2009	220	290	782	7.4	465	92	ND	46	46	42	1.9	53
30S/11E-17E7**	So. Bay Obs. Deep	11/19/2009	ND	100	1100	11.2	427	110	6.1	54	39	1	8.7	110
30S/11E-17E8	So. Bay Obs. Middle	11/20/2009	120	160	455	7.3	255	42	19	12	25	23	1.3	29
30S/11E-17N10	GSWC So. Bay #1	11/20/2009	230	220	638	7.3	357	41	2.4	30	35	33	1.7	37
30S/11E-18K8	10th St. Obs. East	11/20/2009	230	220	620	7.5	378	32	ND	40	51	24	1.8	23
30S/11E-18K9	LOCSD 10th St.	11/20/2009	180	160	539	7.2	307	36	4.6	27	27	24	1.3	32
30S/11E-18L2	LOCSD Palisades	11/19/2009	200	590	1460	7.2	890	360	1.8	39	94	86	2	44
30S/11E-18L6	Palisade Obs. 6"	12/9/2009	270	380	856	7.5	528	68	ND	85	70	50	2.2	36
	18L6 @ 400'	12/9/2009	280	400	857	7.3	535	68	ND	85	76	52	2.2	35
	18L6 @ 500'	12/9/2009	260	440	856	7.4	521	68	ND	84	81	59	2.5	42

ND = Not Detected
*Water sample from 13L7 affected by borehole leakage from upper aquifer
**Water sample from 17E7 affected by high pH. Alkalinity 140 mg/l as carbonate and hydroxide

Legend and Detection Limits

General Mineral	Description	Detection Limit for Reporting
HCO3	Bicarbonate Alkalinity in mg/L CaCO3	2.0
Hardness	Total Hardness in mg/L CaCO3	1.0
Cond	Electrical Conductance in μmhos/cm	1.0
pH	pH in pH units	0.1
TDS	Total Dissolved Solids in mg/L	10.0
Cl	Chloride concentration in mg/L	1.0
NO3	Nitrate concentration in mg/L	0.4
SO4	Sulfate concentration in mg/L	0.5
Ca	Calcium concentration in mg/L	0.03
Mg	Magnesium concentration in mg/L	0.03
K	Potassium concentration in mg/L	0.10
Na	Sodium concentration in mg/L	0.05

EXHIBIT "B"



Explanation

83 / 12J1 — Well location with Nov. 2009 - Jan 2010 chloride data

Estimated extent of 250 mg/l Zone D isochlor

NOTE: the isochlor lines are interpreted from water quality and geophysical data, and include consideration of well construction and use.

approx. basin limits

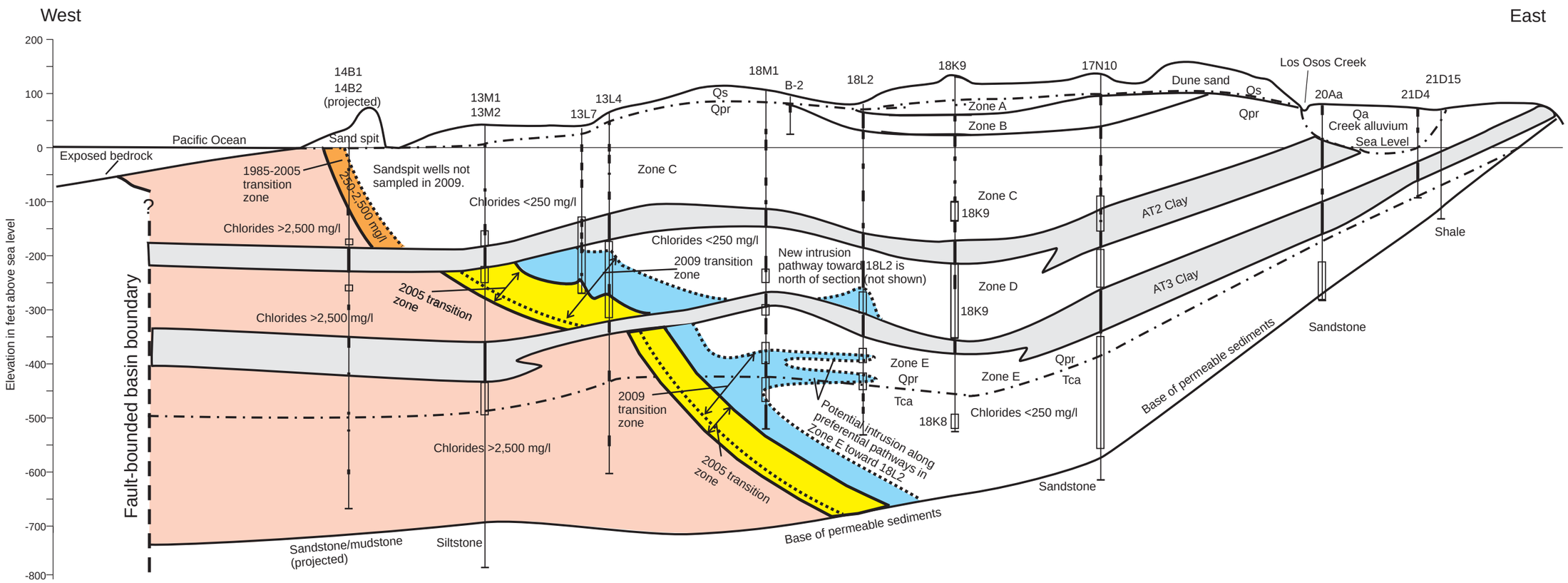
Figure 1

Lower Aquifer
Chloride Concentrations
Nov. 2009-Jan. 2010

Los Osos ISJ

Cleath-Harris Geologists, Inc.

EXHIBIT "B"



See Figure 1 for cross-section orientation

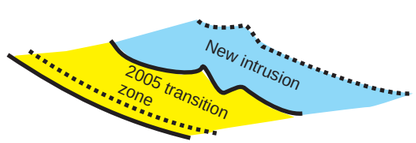
Explanation

Aquifer Zones:
Zone A - Perched Aquifer
Zone B - Transitional Aquifer
Zone C - Upper Aquifer
Zone D - Lower Aquifer (shallow)
Zone E - Lower Aquifer (deep)

Well data point
18M1 Well ID
Clay layer
Well screen

Formation:
Qa - alluvium
Qs - dune sand
Qpr - Paso Robles Formation
Tca - Careaga Formation

200
0
0
2000
Vertical scale: 1" = 200'
Horizontal scale: 1" = 2000'



NOTE: the transition zone lines are estimated from water quality and geophysical data, and include consideration of well construction and use. Solid lines for 2005 estimate, dashed lines for 2009 estimate (a 5-year period). Only Lower aquifer Zones D and E were investigated.

Figure 2

Lower Aquifer
Sea Water Intrusion
Los Osos Valley Groundwater Basin

Los Osos ISJ

Cleath-Harris Geologists, Inc.

Well 30S/10E-13M1

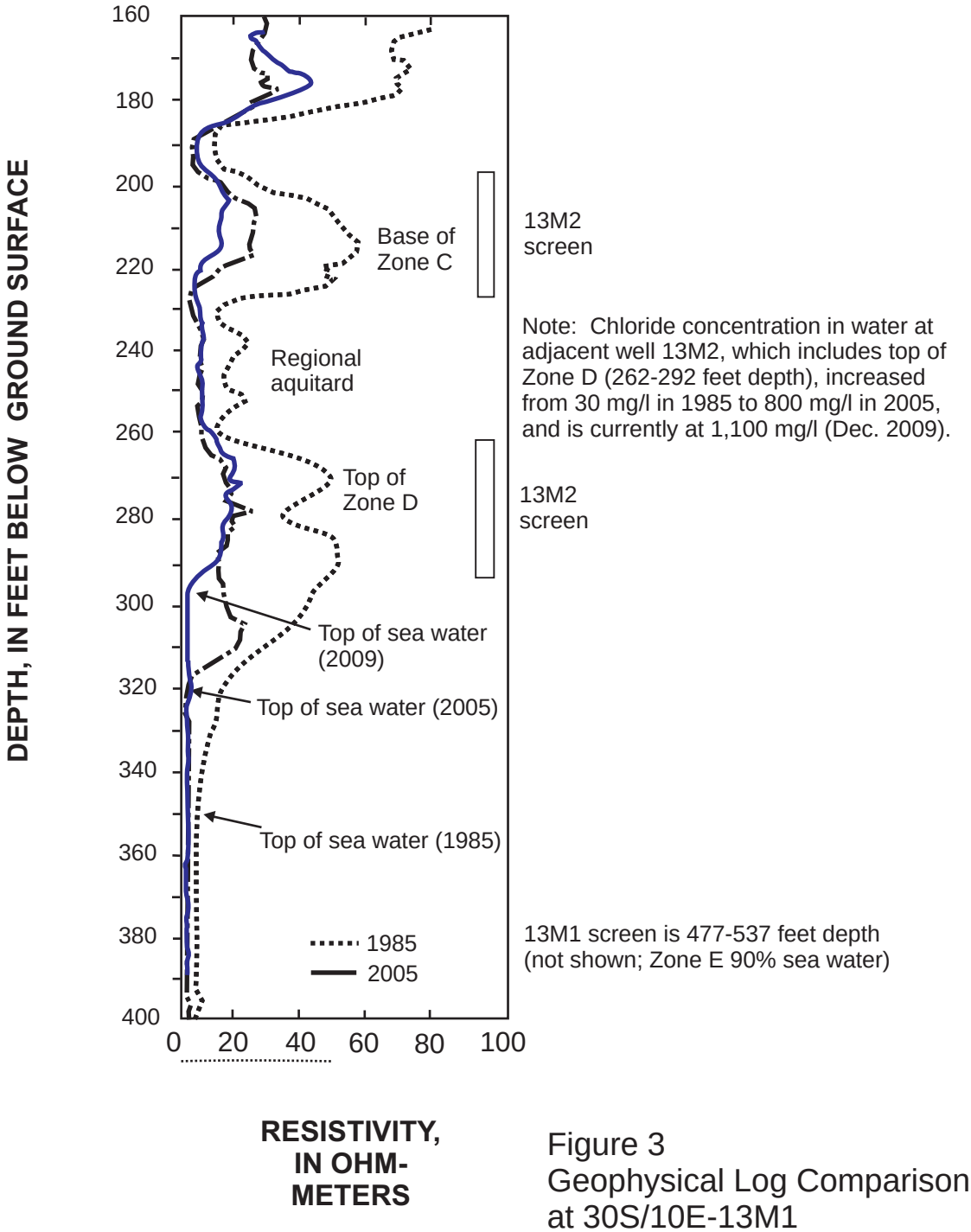


Figure 3
Geophysical Log Comparison at 30S/10E-13M1

Los Osos ISJ

Cleath-Harris Geologists, Inc.

TECHNICAL MEMORANDUM

2171 E. Francisco Blvd., Suite K • San Rafael, California • 94901
TEL: (415) 457-0701 FAX: (415) 457-1638

STETSON ENGINEERS INC.

TO: Mr. Robert Miller, Wallace Group DATE: May 3, 2010

FROM: Peter M. Pyle, P.G., CHG. JOB NO: 2323

RE: Peer Review of the Los Osos Groundwater Model

Stetson Engineers Inc. was contracted by Brownstein Hyatt Farber Schreck, LLP, on behalf of the ISJ Parties to review and evaluate the groundwater model and related technical studies to determine the validity of the model and assumptions. We were also tasked with providing an opinion on the safe yield estimates determined using the model for the urban area and Los Osos Creek Valley portions of the groundwater basin with consideration of climate fluctuations. The contact for the ISJ Parties is Robert Miller of Wallace Group in San Luis Obispo who is managing the contract. Much assistance and additional data was provided by Mr. Spencer Harris of Cleath-Harris Geologists, Inc. (CHG).

Stetson Engineers, Inc. performed the following tasks for this peer review:

1) Reviewed key documents specified in the request for proposals (RFP) as well as additional information listed below.
2) Attended a kickoff meeting with the ISJ Technical Group in December 2009.
3) Conducted a one-day model work session with Spencer Harris of Cleath-Harris Geologists, Inc. of San Luis Obispo.
4) Reviewed the model electronic data and output.

Stetson Engineers, Inc. reviewed the following key reports for this study:

1) Seawater Intrusion Assessment and Lower Aquifer Source Investigation of the Los Osos Valley Groundwater Basin, Cleath and Associates, October 2005.
2) Flow Model Conversion and Urban Area Yield Update, Cleath-Harris Geologists, Technical Memorandum, July 2009a.
3) Los Osos Creek Valley Yield Evaluation, Cleath-Harris Geologists, Technical Memorandum, July 2009b.
4) Appendix D of the Draft Environmental Impact Report, Los Osos Waste Water Project, County of San Luis Obispo, November 2008.

In addition to those studies, the following reports and data were reviewed:

1) Simulated effects of a Proposed Sewer Project on Nitrate Concentrations in the Los Osos Valley Groundwater Basin, prepared for LOCSD and Cleath and Associates, Yates and Williams, November 2003.
2) Hydrogeology and Water Resources of the Los Osos Valley Groundwater Basin, USGS WRIR 88-4081, Yates and Wiese, 1988.
3) Conducted phone discussions with Spencer Harris of CHG on model input and output and basis for key model assumptions.
4) Sent via email requests for selected data and model sensitivity analyses, and reviewed and evaluated these additional data.
5) Los Osos Wastewater Management Plan Update, Technical Memorandum #3, Ripley Pacific Team, July 2006.
6) Comments regarding the Ripley Pacific Team's Technical Memorandum #3, Los Osos Wastewater Management Plan Update, Cleath and Associates, October 2006.
7) A Practical Guide to Groundwater and Solute Transport Modeling, Spitz and Moreno, 1996.
8) Applied Contaminant Transport Modeling, Zeng and Bennett, 1995.
9) A critical review of data on field-scale dispersion in aquifers, Gelhar and others, 1992.

Summary of Findings

While there is uncertainty in all models, the SEAWAT model developed by Cleath-Harris Geologists and recent model results (CHG, 2009a, b) appear reasonable. However, we have several recommendations; 1) The need for additional model documentation including definition of model limitations and uncertainty in the results and technical basis for input data, 2) Model refinement and additional scenarios including evaluation of climatic variability other than sea level rise and development of a monthly transient flow model using the model structure from the existing model with the addition of the STR package of Modflow. The recommendations are discussed in more detail in the various subsections and under Recommendations, below.

The scenario described in CHG (2009b) regarding redistribution of pumping in the basin with an increase in pumping the Los Osos Creek subbasin is reasonable and could be initiated without further modeling or analysis, provided the change is gradual, with continued water level and water quality monitoring and analysis. The model could be updated as the effects of that plan/strategy become more fully understood. The recommended approach is phased redistribution of pumping with contingency plans in place to make adjustments as needed and as ongoing monitoring data indicate.

Model Data and Assumptions

This section of the peer review focuses on important model structure and input data that can significantly affect model results.

Model Structure

Cleath and Associates (2005) report contains the information used as a basis for the current SEAWAT model of the Los Osos groundwater basin including the hydrogeology and structure of the basin, aquifer hydraulic parameters, sources of recharge, water quality (including isotope analysis) and the extent of seawater intrusion. Those data provide a strong foundation on which to build the groundwater flow and seawater intrusion model. The current (CHG, 2009a,b) SEAWAT model consists of four layers representing the three primary water bearing units in the basin and a thick aquitard that extends throughout much of the basin.

Based on the data and reports reviewed, the structure of the model is sound and can effectively simulate hydrologic processes in the groundwater basin, particularly as regards the different characteristics and extent of seawater intrusion in each of the main water bearing units (Zones C, D and E). The Los Osos creek subarea on the eastern side of the Los Osos basin has a slightly different structure which the current model (CHG, 2009 a,b) also suitably represents. The model grid is uniform at 250 x 250 feet which is reasonable for the Los Osos basin given its scale, density of data, and resolution required of model results.

Hydraulic Parameters

A key hydraulic parameter that controls groundwater and seawater flow in the model is horizontal hydraulic conductivity (Kh). Its distribution by layer were requested from CHG and reviewed. The distribution is shown for each model layer in the attached Figures 1 through 4. This distribution was discussed with Mr. Harris and compared to that of pumping test results presented in Cleath and Associates (2005), and supplemental data provided by Mr. Harris.

The K distribution by layer seems appropriate and honors the field test data, which need not be precisely replicated in the model due to field data limitations and scale. I had questions regarding the K distribution representing the Los Osos Creek alluvium which appeared different from that of typical stream alluvium. However, discussions with Mr. Harris confirmed that the K values used in that area honor the unique geology of this region.

This type of information (maps and discussion of aquifer hydraulic properties) should be included in a future report on the SEAWAT model used in the CHG (2009a,b) studies.

Recharge Preprocessor

The 2009 SEAWAT model does not include the upper two geologic units which occur in the western two thirds of the basin including the perched aquifer (Zone A) and the transitional aquifer (Zone B). The upper zones are not generally used for production and are effectively isolated hydraulically from the underlying aquifers (Zones C, D and E) by an extensive clay layer. An unsaturated zone exists between the clay layer and the underlying aquifers although there is some leakage that occurs through it. SEAWAT cannot simulate unsaturated flow while the more recently developed GSFLOW code developed by the USGS has that capability. This limitation of SEAWAT requires that recharge to the saturated flow portion of the model from precipitation, minor tributaries, return flow from irrigation and septic tank seepage be determined by other methods.

For the Los Osos basin this method has been a spreadsheet preprocessor developed by Yates and Williams (2003). That report briefly describes this recharge and nitrogen loading preprocessor program which calculates deep percolation. This model preprocessor was not evaluated in detail for this review. There are many parameters and sources of data which are used in that preprocessor, some of which were changed to develop input for the CHG 2009 SEAWAT model. An Excel worksheet containing the model and input data was provided by Mr. Harris for this review, but the input data could not be evaluated in detail in the time available.

It is suggested that the preprocessor documentation be updated such that the input data sources and methods of calculating deep percolation and evapotranspiration is transparent. Changes to the model for use in successive models should be sufficiently described, accessible and readily available for review. Flow diagrams showing how the spreadsheet preprocessor works and its most sensitive variables should be included. We do not have a suggestion at this time as to whether the preprocessor could be improved or replaced by a more conventional unsaturated flow model due to our limited knowledge of it. However, model code refinements may be available in the near future that will allow simulation of unsaturated flow and seawater intrusion using the same basic data sets as currently used in the current Los Osos model. It is suggested that the model be updated to include unsaturated flow when possible.

Representation of Los Osos Creek

The recharge pre-processor does not include calculation of the recharge from Los Osos Creek to the aquifer in the Los Osos Creek subarea. This is an important component of the model because it allows an increase in recharge as water levels decline in that area due to proposed increased pumping (CHG, 2009b). Recharge is controlled by the model using the RIV module which allows river/creek seepage based on the water level in the creek, the head in the aquifer beneath the creek, and a coefficient based on the width of the creek, creek bed thickness and vertical permeability. While use of the RIV module can produce usable results for this type of creek, the

STR module could have provided a better calibration. The STR module allows the stream flow to reduce or cease during dry periods or seasons, thus providing a limit to how much seepage/recharge can occur from the creek to the aquifer. A recent version of SEAWAT (late 2009 available in GW Vistas updates) is available and should be used in updated versions of the Los Osos model.

In order to evaluate whether the RIV module was properly used to represent Los Osos Creek seepage, two analyses were performed. For the first, Creek flow data and a precipitation graph with a cumulative departure curve was requested from CHG. The Creek flow data is shown in Figure 5. It shows that data is missing for 1983, a wet year, and 1985-93 most of which were dry years. The wet or dry year condition was determined using long term precipitation data with a cumulative departure curve requested from CHG (Figure 6). A comparison of Figures 5 and 6 indicate the creek flow data is skewed to wet years.

The average creek flow for all of the years shown is 3,940 afy with a median of 2,230 afy. If a balance period is selected (Figure 6) which is limited to 1979-81 creek flow data (Figure 5), the average is 2,326 afy with a median of 1,630 afy. This suggests that no more than about 1,600 afy should be allowed by the model to seep from the stream to the underlying aquifer. The results of the increased pumping in the Los Osos creek subarea by CHG (2009b) is well within this limit at 1,013 afy. In addition, the gage from which the flow data in Figure 5 was obtained is located somewhat downstream from the basin and model boundary such that some seepage to the aquifer can occur in the groundwater basin upstream of the gage. The STR package will allow more accurate representation of stream leakage in future revisions of the model.

The second analysis requested of CHG was a sensitivity analysis of the conductance coefficient used in the model RIV module representing Los Osos Creek. CHG went farther than that and performed a sensitivity analysis on all other RIV variables including head in the River. The results of that sensitivity analysis indicate that for a change in creek bed permeability of 100% the change in seepage is less than 1%. For a change in stream bed permeability of 100% and stream width increase of 100% the change in seepage is also less than 1%. The amount of seepage is more sensitive to stream stage with an increase in stream stage of 0.5 feet resulting in an increase in seepage of about 1.4% which is still not large. Mr. Harris has indicated he is aware of this sensitivity and has calibrated stream stage so as not to allow seepage in excess of available stream flow. Again, use of the more recent version of SEAWAT with the STR package and run in transient mode with monthly data, will improve model reliability with respect to the effects of increased pumping in the Los Osos Creek subarea.

<u>Seawater Intrusion Coefficients</u>

Seawater intrusion into the Los Osos groundwater basin is primarily effected by the relative elevations of the ocean and head in each aquifer, difference in fresh and seawater density and the

aquifer coefficient of dispersion, particularly the longitudinal component (dL). This coefficient is an unknown that is dependent upon aquifer permeability and the scale of the intrusion problem. Three technical references were reviewed to evaluate the potential range of this variable for the Los Osos basin, as noted above. CHG was requested to perform a sensitivity analysis of the coefficient of longitudinal dispersivity. The results are shown below in Tables 1 and 2 for the 50 year calibration.

Table 1. Chloride 250 mg/l isochem - Distance from coastline 2005 (in feet)

Model Zone/Layer	Measured/Estimated	Calibration (dL/dT/dV)	Low range (dL/dT/dV)	High Range dL/dT/dV
		(100/20/2)	(10/2/0.2)	(200/40/4)
C/1	1,500	2,000	2,000	2,000
D/3	2,500 – 5,500	2,500 – 5,400	2,400 – 5,100	2,600 – 5,700
E/4	3,000 – 7,500	3,000 – 4,800	2,900 – 4,500	3,000 – 5,000

Note: dL = Longitudinal Dispersivity, dT =Transverse Dispersivity, dV = Vertical Dispersivity

Table 2. Change in distance of Chloride 250 mg/l isochem relative to calibration (in feet)

Model Zone/Layer	Calibration (dL/dT/dV)	Low range (dL/dT/dV)	High Range (dL/dT/dV)
	(100/20/2)	(10/2/0.2)	(200/40/4)
C/1	0 ft	0	0
D/3	0	-300	+300
E/4	0	-250	+250

The longitudinal, transverse and vertical dispersivities are related and are generally express as a ratio. Table 1 indicates the model simulated accuracy relative to the dL of 100 used in the model and to a wide range of values. Table 2 indicates the relative sensitivity of the model to the same range. The results indicate the model is surprisingly insensitive to longitudinal dispersivity and that the differences in simulated intrusion under the wide range of coefficients simulated is only 300 feet or about one model cell width after 50 years.

In addition to the analyses discussed above, Stetson Engineers requested that CHG provide a composite map of the simulated and measured extent of seawater intrusion as of 2005, the end of the 50 year calibration period to determine visually how well the model matches the data base on the 250 mg/l Chloride isochem. Figure 7 shows the results provided by CHG where the green

area represents the 250 mg/l Chloride isochem as a wedge in Zone D due to density differences and the blue line (0.03 isochem) represent the model simulated extent of the 250 mg/l Chloride isochem in the middle of the aquifer. The model appears to match the data relatively well. A comparison of columns 2 and 3 in Table 1 provides a more precise measure of this difference.

SEAWAT Model Limitations

The current transient calibration for the SEAWAT model only represents three multi-year period and the predictions are run with steady-state (average hydrologic) inputs. This increases the uncertainty in the model for calibration and prediction of monthly water levels, recharge, stream seepage and storage change during critical dry periods. While the model structure is in place for developing a monthly transient calibration, it may take significant time and effort to calibrate the SEAWAT model. This is primarily due to known problems with numerical instability in SEAWAT when running in transient mode. This effort may be warranted in the long term but, in the short term the suggested redistribution of pumping to the Los Osos Creek area need not be delayed. In future model updates it is suggested that the model be calibrated with monthly stress and the STR package to better represent Los Osos Creek seepage to the underlying aquifer.

While careful use of the RIV module can result in reasonable results as discussed above, this is still a model limitation that, when combined with the absence of a transient SEAWAT calibration is of concern with respect to more precise evaluation of management alternatives. Note that what is suggested is more accurate predictions, and not that the current SEAWAT model does not provide useful results.

Model Results and Uncertainty

Although it was not a part of the scope of work for this review, it was hoped that an estimate of the uncertainty of the extent of predicted sweater intrusion and subbasin safe yield under future management scenarios could be provide in this review. However, as with most models, this is best defined by the developer of the model who is most familiar with the model, its input data and limitations. As suggested below, some estimate should be placed on these model results (current and future) for the purpose of assisting decision makers in allowing consideration of alternate plans should the model not prove100% accurate.

All models have an inherent degree of uncertainty. That does not invalidate their results, but knowing the uncertainty in key results is important for the planning process. In this case, such planning could include a gradual shift in municipal pumping to the Los Osos Creek subarea with appropriate monitoring to evaluate the effects of such a change, which will likely be slow to occur. Planning could therefore include various steps that could be taken should underpredicted,

but not surprising results occur. For example large storage declines during dry periods in the Los Osos Creek subarea when pumping there is increased, or seawater intrusion does not slow at the rate expected, or the reduction in septic tank seepage does not slow at the rate expected, etc.

Seawater Intrusion

The model calibration provides reasonable results as noted above. However, there is likely some uncertainty regarding the exact extent of the landward movement of seawater intrusion under predictive scenarios. It is important to note that when making a comparison between predictive model simulations that the relative difference between the extent of seawater intrusion that is important for evaluating basin management alternatives rather than the absolute value of the extent of seawater intrusion or specific Chloride concentrations at any one location due to model limitations discussed above.

Given the limitations of SEAWAT, the Recommendations discussed below include suggestions for evaluating dry period, seasonal and intermittent stream conditions by updating the current model using monthly transient stress periods.

Safe Yield Estimates

The safe yield estimate for the Urban Area of 3,200 afy (CHG, 2009a) is a reasonable long term average estimate, but with limitations discussed above regarding the uncertain response of the aquifers during extended dry periods. It is suggested that a +/- value be added to that estimate based on model uncertainty.

The SEAWAT limitations regarding the RIV module to simulate leakage to the aquifer have been address above, and the additional recharge under the scenario of expanded pumping in this area is reasonable due to consideration of this limitation by CHG. An uncertainty range could also be added to the Los Osos Creek subarea safe yield estimate of 3,150 afy (CHG, 2009b) for the same reasons. Additional recharge from Los Osos Creek is an important component of this estimate. Improvements in model accuracy could be made through a monthly transient calibration of the existing SEAWAT model using the updated code with STR package capability. Reporting on an improved version of the model should still include a section on uncertainty.

Conclusions

The current SEAWAT model and results regarding seawater intrusion and safe yield provides usable results on which to base near-term changes in pumping distribution to mitigate seawater intrusion (CHG, 2009a, b). However, it is suggested that uncertainty values should be assigned by CHG to the model results given the model limitations to assist decision makers in their choice of action and any additional measures that should also be considered. Our involvement with the USGS in other basins indicates they include, and recommends others include, a limitations and uncertainty section in model documentation (W. Danskin, USGS Research Hydrologist, 2009). SEAWAT is an appropriate model code for the Los Osos basin for evaluation of the average groundwater basin budget (including basin and subarea yields), the extent of seawater intrusion, and for use in evaluating the relative effects of development and changes in basin management or climate variability.

Recommendations

Although recommendations were not requested as part of this review, they are included in the text above and summarized below.

1) Add uncertainty values to seawater inflow extent and rate, and safe yield estimates in CHG (2009 a,b) and future model documentation, memos, etc.
2) Calibrate SEAWAT in monthly transient mode and use the STR package to represent Los Osos Creek. Use a long period of record that includes the critical dry period for the region. Repeat the same hydrologic period for predictive simulations.
3) Continue to review climate change literature and determine if a comprehensive scenario regarding climate change should be run using an updated version of the model.
4) Write up the Yates preprocessor used to estimate deep percolation to the saturated flow model (SEAWAT, MODFLOW, etc) including diagrams, screen capture or other method to show how model the works, include the source of model input data, what variables are usually changed for predictive runs and which variables are most sensitive. This preprocessor provides significant input to the flow models and more complete information is needed.
5) Additional model documentation is needed on the SEAWAT model for the Los Osos Creek Basin including assumptions, maps of hydraulic property distributions by layer, stream input data, reference to the unsaturated flow preprocessor and changes to input for model simulation, and other details sufficient for a complete understanding of the model.
6) For the benefit of users of model results, future reviewers or model users it is suggested that a summary of Los Osos models and related documents be prepared. This documentation should include, at a minimum, a table with; a) the model code used, b) whether transient or steady state, c) period simulated (calibration and prediction) and stress period length, d) if Yates preprocessor or other method used to estimated deep

percolation, f) if transport, which species were simulated, and g) date and title of key documentation. This would have saved the reviewer a lot of time in trying to determine relevance and differences between these models listed below.

- Yates and Weise,1988
- Yates and Williams, 2003
- URS, 2000
- CHG 2005
- CHG 2009a, b

REGISTERED GEOLOGIST
PETER M. PYLE
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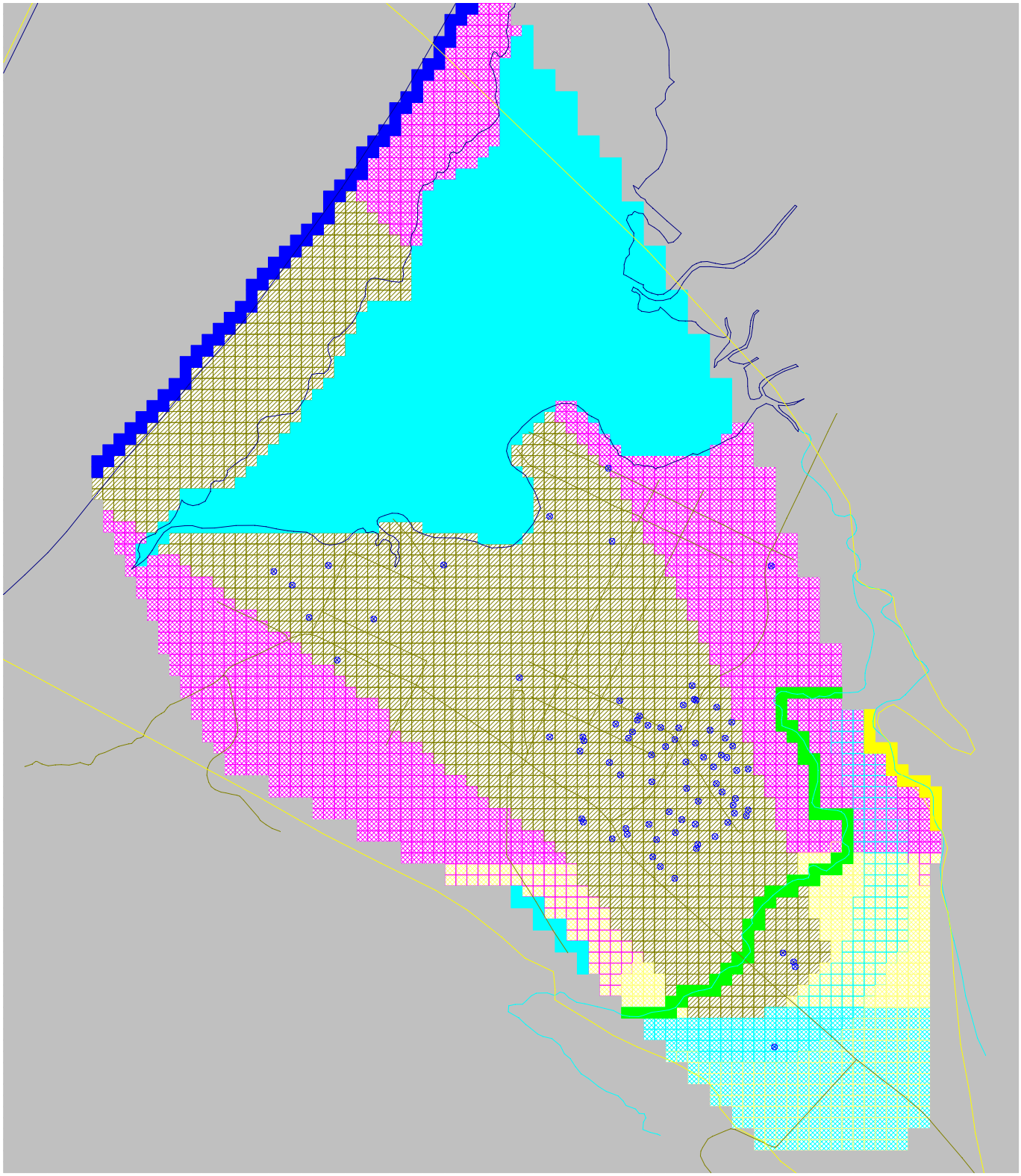
EXHIBIT "C"



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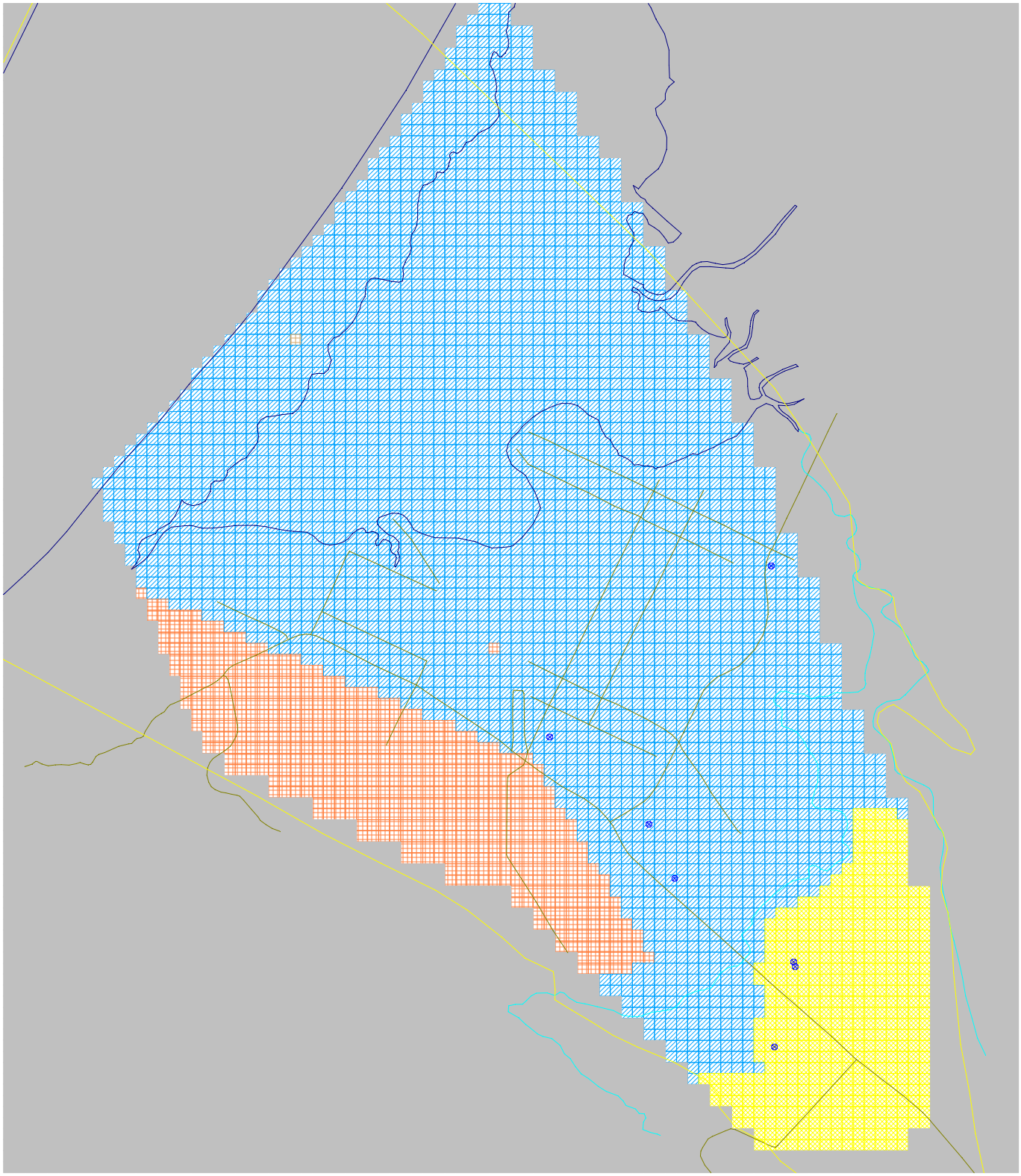

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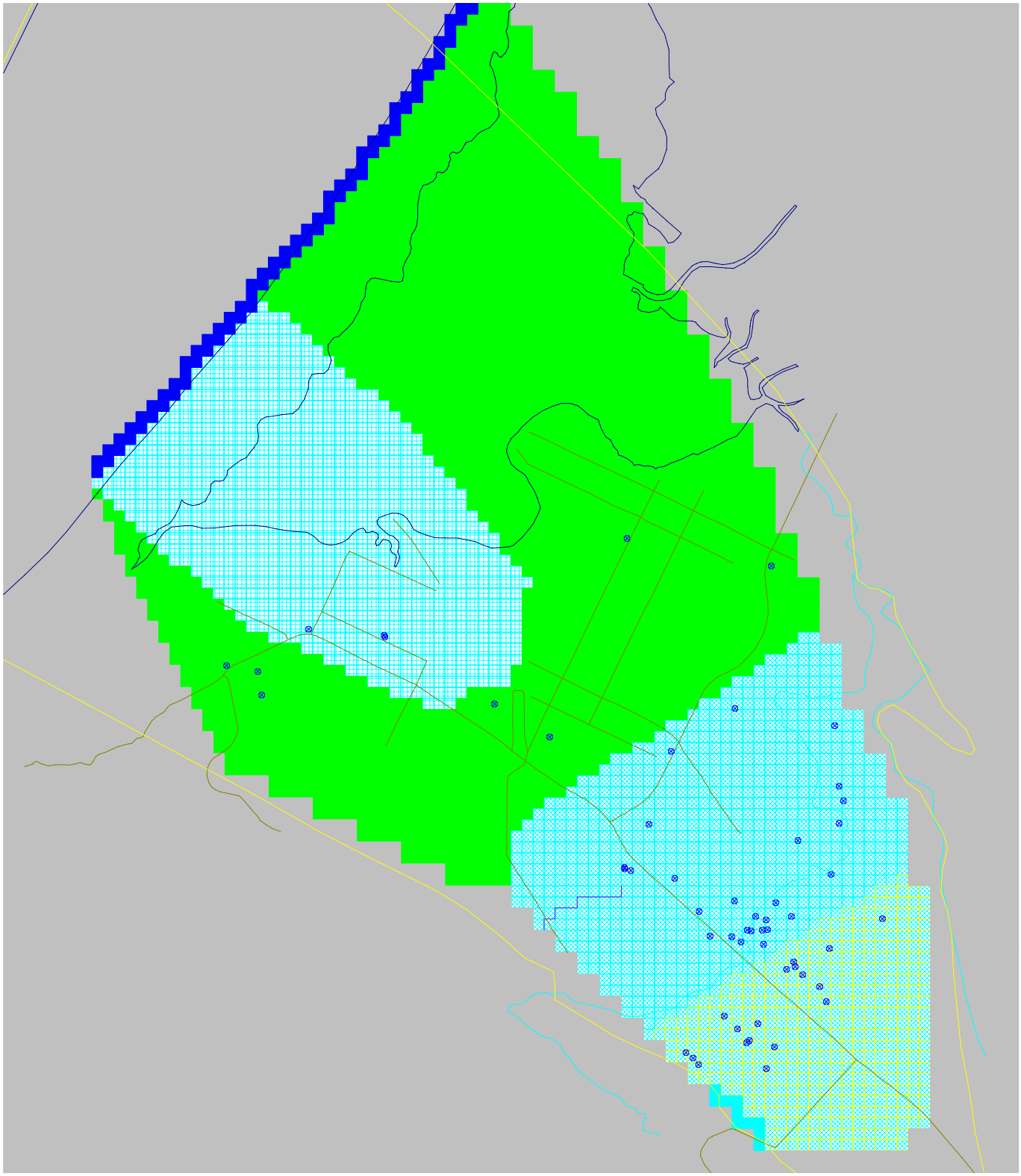

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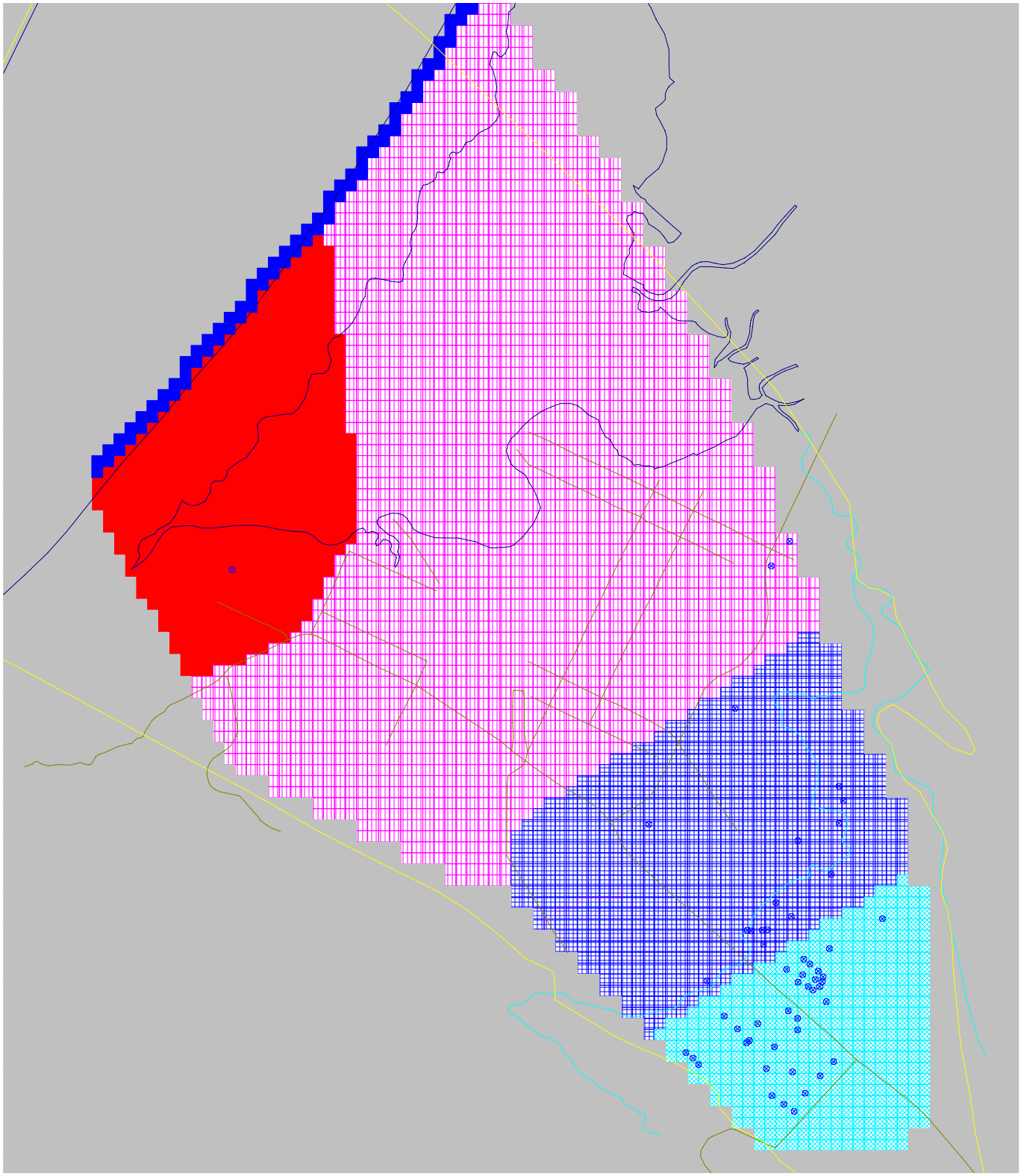

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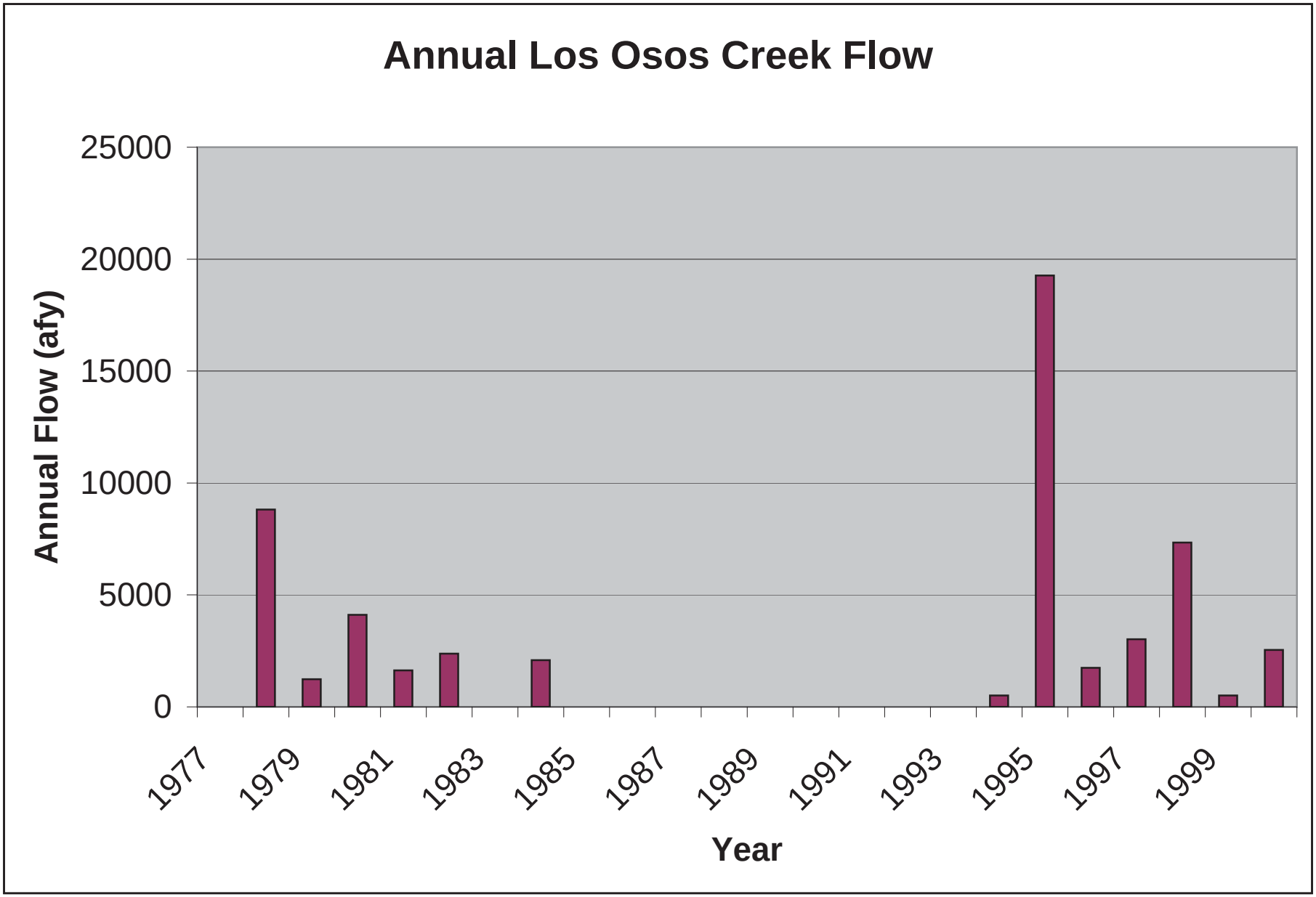


Figure 5. Annual Los Osos Creek Flow (1978-2002)

Figure 6
Cumulative Departure Curve
Los Osos Station 197 (South Bay Fire Dept.)

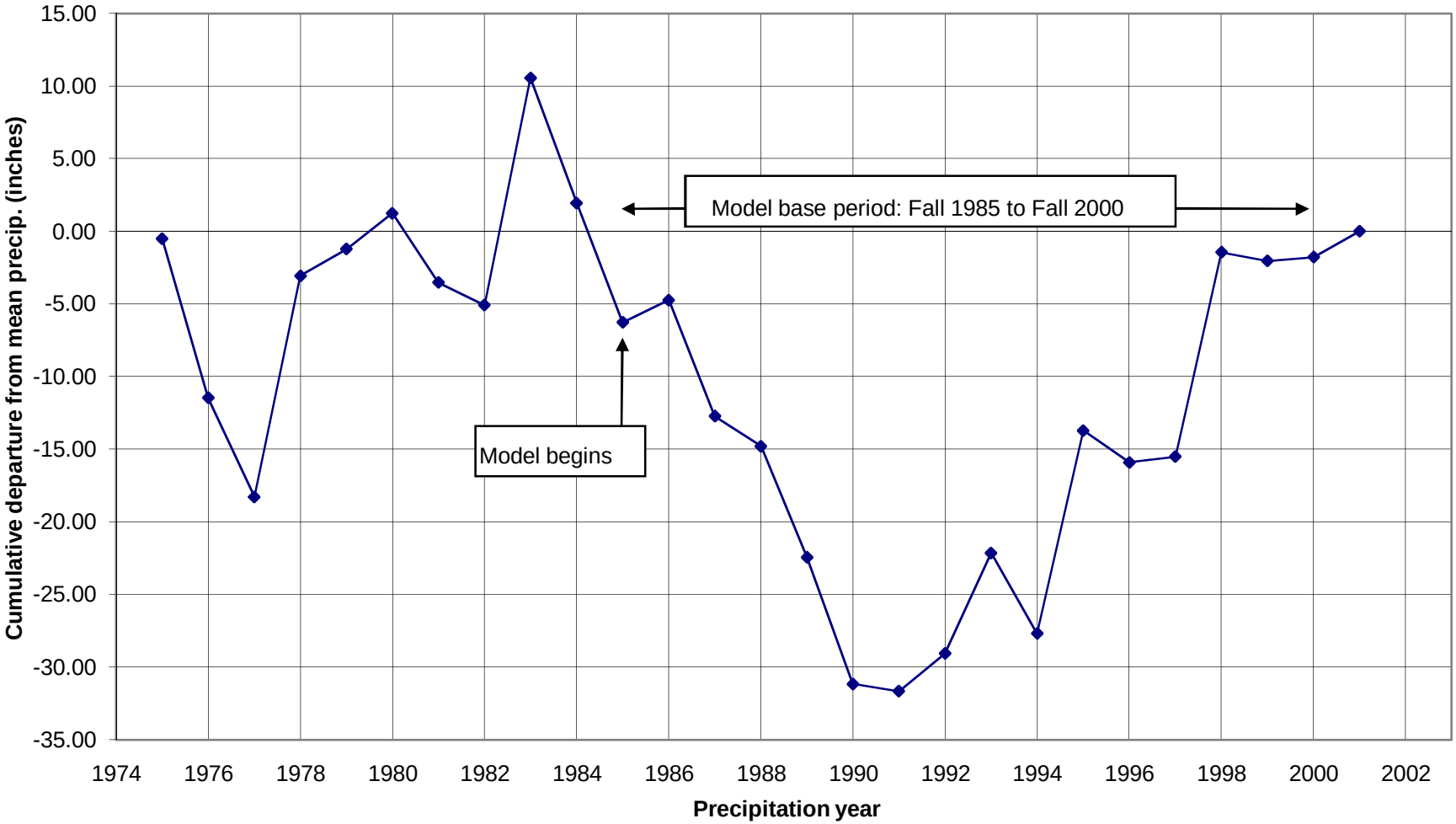
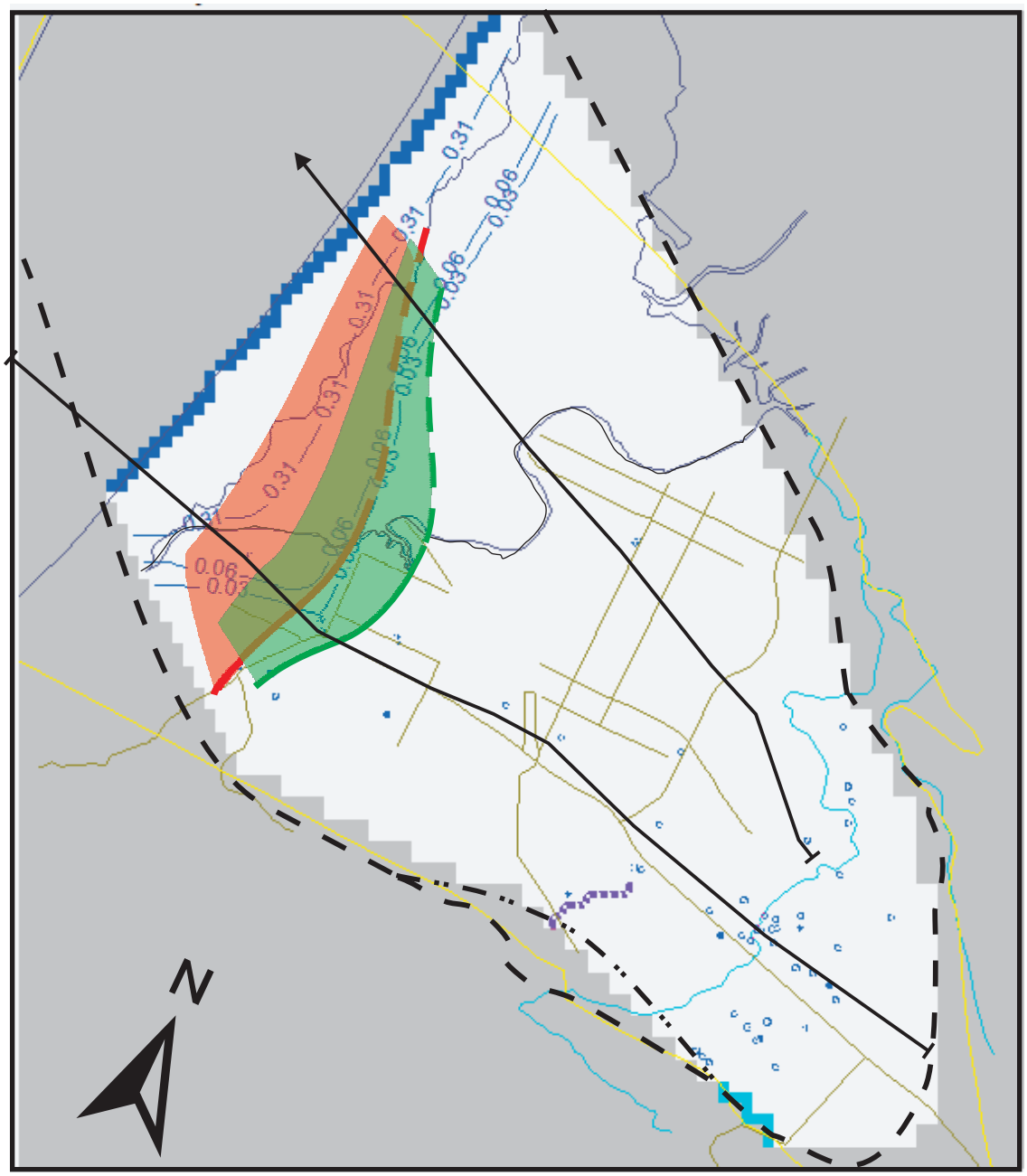


Figure 7. Zone D, measured and simulated extent of seawater intrusion, 2005.



Scale 1" = 4000 feet

Simulated TDS isoconcentrations in lb/ft3

0.03 lb/ft3 = 500 mg/l TDS ≈ 250 mg/l Chloride
0.06 lb/ft3 = 1,000 mg/l TDS≈ 500 mg/l Chloride
0.31 lb/ft3 = 5,000 mg/l TDS≈ 2,500 mg/l Chloride

2005 Transition Zone:

Estimated extent of 2500 mg/l
Zone D isochlor (shading shows change with depth)

Estimated extent of 250 mg/l
Zone D isochlor (shading shows change with depth)

~~Figure A3~~

TDS Isoconcentrations
Calibration Run-2005 Zone D
May 2009 SEAWAT Model
Los Osos ISJ Group

Cleath-Harris Geologists, Inc.

ISJ Aug. 2008

FINAL

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Attorneys for Defendant GOLDEN STATE WATER COMPANY

FILED
AUG 05 2008
SAN LUIS OBISPO SUPERIOR COURT
BY Patt Holmes
Patt Holmes, Deputy Clerk

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SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF SAN LUIS OBISPO

LOS OSOS COMMUNITY SERVICES DISTRICT, Plaintiff, vs. GOLDEN STATE WATER COMPANY, S&T MUTUAL WATER COMPANY, COUNTY OF SAN LUIS OBISPO, SEA PINES GOLF COURSE, DOES 1 THROUGH 500, INCLUSIVE, Defendants.	CASE NO. GIN 040126 [Assigned for All Purposes to the Honorable Teresa Estrada-Mullaney] INTERLOCUTORY STIPULATED JUDGMENT [COMPLAINT FILED 02/13/04]

Attachment B-1

ISJ, Aug. 2008

PRELIMINARY FINDINGS

A. Complaint

On or about February 13, 2004, Los Osos Community Services District ("LOCSD") filed a complaint in the San Luis Obispo County Superior Court, Case No. GIN 040126 ("Complaint"), against Golden State Water Company ("GSWC"), formerly known as Cal Cities Water Company, S&T Mutual Water Company ("S&T"), Sea Pines Golf Course ("Sea Pines"), the County of San Luis Obispo ("County"), and others, seeking a declaration of the Parties' relative rights to use water resources of the Los Osos Valley Groundwater Basin ("Basin") located in San Luis Obispo County, California. The Parties entered into a Stipulation of Parties As to Standstill Agreement, which was approved by the Court on May 25, 2004 and stayed all pleadings in the litigation to allow the Parties to hold settlement discussions. No defendant has filed with the Court a responsive pleading pursuant to California Code of Civil Procedure section 430.10. GSWC filed a Motion to Transfer Action to a Neutral County or for Assignment of a Disinterested Judge from a Neutral County on March 26, 2004. That motion was not heard by the Court, but was subject to the stipulation described above. The Court held several Case Management Conferences at which the Court extended the effectiveness of the standstill period under the Stipulation of Parties As to Standstill Agreement through the effective date of this Interlocutory Stipulated Judgment ("ISJ"). On or about December 19, 2006, Sea Pines was dismissed as a defendant to the Complaint.

B. Assembly Bill 2701

On September 20, 2006, the Governor of the State of California signed Assembly Bill 2701. AB 2701 added, *inter alia*, section 25825.5 to the Government Code, subsection (c) of which provides that:

> The [County] may undertake any efforts necessary to construct and operate a community wastewater collection and treatment system to meet the wastewater collection and treatment needs within [LOCSD]. These efforts may include programs and projects for recharging aquifers, preventing saltwater intrusion, and managing groundwater

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ISJ, Aug. 2008

Attachment B-2

resources to the extent that they are related to the construction and operation of the community wastewater collection and treatment system. These efforts shall include any services that the [County] deems necessary, including, but not be limited to, any planning, design, engineering, financial analysis, pursuit of grants to mitigate affordability issues, administrative support, project management, and environmental review and compliance services. The [County] shall not exercise any powers authorized by this section outside [LOCSD].

Not accurate

Pursuant to that statutory authorization, the County is proceeding with efforts necessary to construct and operate a community wastewater collection and treatment system in the Los Osos area.

C. Resource Management System

On March 27, 2007, the County certified a Severity Level III for water resources of the Basin pursuant to the County's Resource Management System. Under that County system, Level III indicates an "Unavoidable Resource Deficiency," defined as follows: "This is the most critical level of concern. Level III occurs when the capacity (maximum safe yield) of a resource has been met or exceeded. At Level III there is a deficiency of sufficient magnitude that drastic actions may be needed to protect public health and safety."

D. Jurisdiction

This Court has jurisdiction to enter this ISJ declaring the Plaintiff's and Defendants' ("the Parties") agreement for resource preservation and management of the Basin pursuant to the California Constitution, Article X, Section 2.

E. Parties

1. LOCSD is a public agency organized under the Community Services District Law, codified at California Government Code sections 61000 *et seq.*, that provides water to its water customers for municipal and industrial uses within its water service area in the unincorporated community of Los Osos.

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G. Settlement Negotiations

The Parties have an interest in the efficient and coordinated management of groundwater, and have stipulated to the entry of this ISJ. Each of the Parties stipulates that this ISJ will establish a process for developing and implementing a Basin Management Plan ("BMP") that includes the components described in Section II below.

JUDGMENT

IT IS HEREBY ORDERED, ADJUDGED AND DECREED:

I. TERM

This ISJ shall become effective on the date it is approved by the Court (the "Effective Date") and shall remain in effect until terminated as otherwise provided in this ISJ.

II. PURPOSE AND CONTENT

The purpose of this ISJ is to establish a process for developing and implementing a BMP that will serve as a physical solution for the management of Basin water resources, resolving all issues raised in the Complaint. Unless otherwise agreed, the BMP shall include, but shall not be limited to the following components:

A. A hydrologic assessment of the Basin, its water resources and safe yield;

B. A strategy for maximizing the reasonable and beneficial use of Basin water resources while ensuring: the long-term integrity and viability of the Basin as a potable water supply for the Parties collectively and each Party individually, including water quantity and water quality; and the sustainability of environmentally sensitive areas within or influenced by the Basin hydrology;

C. Equitable sharing of costs related to data gathering and analysis, and development and implementation of the BMP;

D. Quantification of each Party's rights to rely on the Basin water resources;

E. Strategies to maximize the grant funding opportunities for ongoing BMP implementation;

F. Administration of a well abandonment and well construction program;

G. Setting water conservation goals;

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Attachment B-3

ISJ Aug 2008

V. COUNTY GROUNDWATER MANAGEMENT

A. The other Parties agree to work cooperatively with the County to implement its Resource Management System with respect to the Basin. The County agrees to consult the other Parties prior to taking any action related to its Resource Management System. For purposes of this agreement, such consultation shall, at a minimum, consist of reasonable advance notice by the County of any such proposed actions; reasonable consideration by the County of the viewpoints of the other Parties with respect to any such proposed actions; and a reasonable opportunity for the other Parties to provide comments, objections and suggested alternative courses of action to the County prior to final action by the County. Except as otherwise provided in this ISJ, or as otherwise provided in agreements executed pursuant to this ISJ, nothing in this ISJ shall diminish the County's authority to regulate land use and development within the lands that overlie the Basin.

B. The other Parties agree that this ISJ shall not preclude the County from adopting and enforcing a groundwater management ordinance with respect to the area overlying the Basin, to the extent that such ordinance is consistent with the BMP. To the extent such County ordinance may be inconsistent with the BMP, the other Parties retain the ability to object to the ordinance by all applicable methods. Prior to adopting an ordinance, the County shall consult the other Parties, with consultation to include the measures described in Section V.A. above.

VI. INTERCONNECTION PLAN

The Purveyors agree that they will promptly develop plans to improve existing interconnections and install additional interconnections between the GSWC, LOCSD and/or S&T water distribution systems so that in the event GSWC, LOCSD or S&T experience water quality problems or loss of groundwater production capacity in the Basin, the other Purveyors, to the extent practical, shall provide mutual assistance as necessary in responding to water quality or water quantity constraints impacting any individual system ("Interconnection Plan"). The Purveyors shall develop an agreement on the cost allocation associated with implementing the Interconnection Plan. The Purveyors shall also establish a mutually acceptable wholesale water rate for water provided through the interconnections, subject to the approvals of Section VIII below. The Purveyors shall

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B. The Parties acknowledge that there may be additional third-party approvals required for funding or implementation of this ISJ or portions thereof, including LOCSD's compliance with article XIIID, section 6 of the California Constitution in approving water rate increases. The Parties agree that the Party needing such an approval will use reasonable best efforts to obtain the approval when required, and the other Parties agree to cooperate in good faith to assist the Party seeking approval. The Parties agree that in the event the Party needing approval is unable to obtain approval for any funding or implementation related to this ISJ, that Party shall not be required to fund or implement that task, and the failure of that Party to fund or implement that task shall not be deemed to constitute a breach of this ISJ.

IX. WORKING GROUP

A. The Parties shall establish a working group ("Working Group") that shall meet as often as necessary to fulfill the purposes of this ISJ. Each Party shall assign its representatives, as they each deem appropriate, with the goal of maintaining continuity and committing adequate resources and expertise so that the purposes of this ISJ may be achieved.

B. The Parties acknowledge that each of them individually has a different required approval process that may be necessary to amend this ISJ, adjust a Budget or otherwise commit to some type of performance. The Working Group shall have no authority to commit or adjust the obligations of any individual Party.

C. Other parties may be added to the Working Group by mutual consent of the Parties.

X. FAILURE TO REACH AGREEMENT ON THE BMP

A. Prior to reaching agreement on the BMP, and except as provided herein, any Party may terminate this ISJ, and reinitiate the underlying litigation as may be amended from time to time; provided, however, that this ISJ may not be terminated by any Party unless and until that Party has completed the dispute resolution process provided in Section XI. Any Party desiring to terminate this ISJ after completion of the dispute resolution process may do so by giving thirty (30) days advance written notice of termination of the ISJ to the other Parties, and filing said notice with the Court. Thirty days after giving such notice, the terminating Party shall have no further duties, rights

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or liabilities except for fulfilling those duties, rights or liabilities related to additional studies commenced prior to withdrawal and those obligations, duties, rights or liabilities related to the Interconnection Plan.

B. The effect of the filing of a notice of termination shall be as follows: (a) this ISJ shall be of no further force or effect, other than those provisions within Section XI providing for reinitiation of the underlying litigation; (b) responsive pleadings shall be filed on or before the thirty-first (31st) day following the date of filing with the court the notice of termination; (c) no Party shall have waived any rights, claims or counter-claims provided under California Code of Civil Procedure sections 430.10; (d) no Party shall be deemed to have waived any basis for objection to the Complaint, including any basis for dismissal, demurrer or motion to strike, any counter-claim, any defense or any affirmative defense; and (e) no Party shall be deemed to waive any rights, claims, counter-claims or defenses provided under California Code of Civil Procedure section 394.

XI. RETAINED JURISDICTION AND DISPUTE RESOLUTION

A. Jurisdiction, power and authority are retained by and reserved to the Court solely to enforce the terms of this ISJ. Nothing in the Court's reserved jurisdiction shall authorize it to modify or amend the ISJ, except with the unanimous consent of all Parties.

B. In the event a dispute arises between the Parties regarding the implementation of this ISJ or the acceptable terms of the BMP prior to its completion, the Parties agree to submit such disputes to mediation before an impartial mediator selected by the mutual agreement of the parties. Any Party may initiate the mediation process by providing written notice of dispute to all other Parties, setting forth the nature of the dispute and a proposed resolution. Within fifteen (15) days of receiving the notice of dispute, the Parties shall either mutually agree to a mediator, or else refer the selection of a mediator to the Court. Mediation of disputes shall commence within thirty (30) days of the selection of a mediator. If necessary, the Parties will pay for the services of the mediator in accordance with the proportions described in section VII.A above. The Parties shall make a good faith effort to resolve all disputes informally, or through mediation. Any Party participating in good faith in the mediation shall be deemed to have satisfied the requirements of the dispute resolution

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March 11, 2011

Mr. David LaCaro, Environmental Scientist II
Regional Water Quality Control Board, Central Coast Region
895 Aerovista Pl., Ste. 101
San Luis Obispo, CA 93401-7906

Via E-Mail to dlacaro@waterboards.ca.gov

Re: Waste Discharge Requirements for the Los Osos Water Recycling Facility (Draft Order No. R3-2011-0001 & Draft MRP Order No. R3-2011-0001)

Dear Mr. LaCaro:

We submit these comments on behalf of our client, Citizens for a Sustainable Community (Citizens), for consideration by the Central Coast Regional Water Quality Control Board (CCRWQCB) in deciding whether to approve the waste discharge requirements (WDRs) proposed for the Los Osos Water Recycling Facility (LOWRF), a project of the County of San Luis Obispo (County).[1] For the reasons set forth below and based on the additional information contained in the attached addendum and exhibits, we request that before the CCRWQCB takes any action approving the draft WDRs, it order preparation and public circulation of a subsequent or supplemental environmental impact report (SEIR), and consider the information in that SEIR. Such a course of action is mandated by the California Environmental Quality Act (CEQA) (Pub. Res. Code § 21000 et seq.) and the State CEQA Guidelines (Guidelines) (Cal. Code Regs., tit. 14, § 15000 et seq.), among other things, due to new information of substantial importance that was not known -- indeed, did not exist -- and could not reasonably have been known and considered in 2009, when the County certified the environmental impact report (EIR) for the LOWRF project

[1] Please note that in the addendum attached to this letter, the LOWRF project is referred to as the Los Osos Wastewater Project (LOWWP) -- the project name used by the County.

(acting as lead agency under CEQA).[2] Furthermore, as proposed, the CCRWQCB's action on the project will violate CEQA for additional reasons and will also violate the Porter-Cologne Water Quality Control Act (Porter-Cologne Act) (Water Code § 13000 et seq.).

The CCRWQCB correctly notes that because it has discretionary review and approval power over the LOWRF project through its statutory responsibility to prepare WDRs, the CCRWQCB is a "responsible agency" within the meaning of CEQA for the purpose of environmental review of and action on the WDRs. (Guidelines, § 15381; see also § 21069.) An activity that involves the issuance to a person of a lease, permit, license, certificate, or other entitlement for use by one or more public agencies is subject to the CCRWQCB's CEQA review. (See § 21065, subd. (c).)

The CCRWQCB Must Prepare an SEIR and Comply with Its Duties as a Responsible Agency Under CEQA Before Approving the Draft WDRs.

Section 21166 and Guidelines sections 15162 and 15163 require the preparation of an SEIR when (1) substantial changes occur with respect to the circumstances under which a project is undertaken, such that revisions of the EIR are necessary due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects; or (2) new information of substantial importance which was not known and could not have been known with the exercise of reasonable diligence when the EIR was certified becomes available, showing that: (i) the project will have one or more significant effects not discussed in the EIR; (ii) significant effects previously examined will be substantially more severe than shown in the EIR; (iii) mitigation measures or alternatives previously found infeasible would in fact be feasible and would substantially reduce one or more significant effects of the project; or (iv) mitigation measures or alternatives considerably different from those analyzed in the previous EIR would substantially reduce one or more significant effects on the environment.

Substantial changes in physical baseline conditions under which the LOWRF project is undertaken have occurred and new information, including hydrologic data, has become available, meeting the criteria of section 21166 and Guidelines section 15162. The Los Osos Basin Plan Update publicly released in May 2010 (over seven months after certification of the EIR) by an interagency working group consisting of representatives from the County and the area's three major water purveyors shows rapidly accelerating seawater intrusion into the Los Osos Valley groundwater basin, the region's only drinking water source. As the CCRWQCB's staff report notes, according to the 2009 EIR, based on investigation data between 1985 and 2005, the rate of seawater intrusion into aquifer zones D and E are *60 and 54 feet per year*, respectively, but the May 2010 Basin Update now shows that the seawater wedge has extended into the same aquifer through fingers at the significantly higher rate of *700 feet per year*. The plume now reaches as far inland as a well near Los Osos Community Park and Los Osos Valley Rd. The saltwater movement data thus indicate a substantially more severe public health threat to water supply than previously known, and the County and the relevant water agencies no longer believe water demand is within safe yield (+/- 3,200 AFY) without measures counteracting this change.

[2] All unlabeled section (§) references in this letter are to CEQA provisions contained in the Public Resources Code.

Additional independent expert review of the Plan Update by Mr. Eugene Yates, a hydrogeologist, confirms that the recently discovered substantially accelerating seawater intrusion into the basin is an "extremely urgent" problem that requires urgent action, including 500 AFY of reduced pumping from the urban compartment. (Review dated August 3, 2010, at 1 [attachment #3 to our addendum].) Yates also recommended the review of a wide range of mitigation options to address changes in basin conditions, given that the LOWRF project, in conjunction with the increased pumping from the upper aquifer may induce seawater intrusion *in the upper aquifer*. Yates opined that accelerating seawater intrusion makes the LOWRF project's recycled water reuse program -- viewed as key mitigation for the LOWRF -- outdated, and may indeed make it nonviable.

The changed baseline conditions and new information are important as there is a direct nexus between seawater intrusion in the Los Osos groundwater basin, the rate thereof and the LOWRF project. As designed, the project, which includes the decommissioning of the onsite wastewater disposal systems in the prohibition zone, contributes to the environmental and public health effects (sodium contamination of the freshwater) of seawater intrusion by reducing groundwater recharge.[3] As noted in the Hopkins Groundwater Consultants report prepared for the 2009 EIR, project operation results in a net deficit of groundwater recharge and aquifer volume. The changed baseline conditions and new information concerning changes in the basin's freshwater/seawater interface thus are highly relevant to the CCRWQCB's environmental review of the LOWRF project, since with substantially accelerated landward saltwater movement into the drinking water reservoir, public health effects will now be substantially exacerbated, and the project will result in new, as yet unexamined, indirect and cumulative significant effects, including public health effects.[4] In this instance, for the CCRWQCB to "use its best efforts to find out and disclose all that it reasonably can," and conduct "thorough investigation," as it must under CEQA (Guidelines, §§ 15144, 15145), goes to the heart of the CCRWQCB's healthy watersheds vision. That vision is one of keeping groundwaters "near natural levels in quantity and quality for water supply purposes and for base flow for sustaining creek habitat, and migratory fish routes," while protecting watersheds "from hydromodification that adversely affects recharge area functions, or the stability of creeks' beds or banks." (CCRWQCB Dec. 11, 2011 Vision Message, at 1-2 & fn. 2 [<http://www.swrcb.ca.gov/centralcoast/publications_forms/publications/vision/docs/Agencies_ltr.pdf>, as of March 10, 2011].) Yet, as proposed, the WDRs include no "end-of-pipe" requirements or mitigations to reduce or

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[3] Loss of groundwater recharge lowers the water level (head) in the aquifer, which reduces the flow of freshwater to seawater. This flow reduction, in turn, allows inland movement of the seawater-freshwater interface. (See, e.g., U. S. Geological Survey, *Saltwater Intrusion in Los Angeles Area Coastal Aquifers-The Marine Connection* (2002 Fact Sheet) [<http://pubs.usgs.gov/fs/2002/fs030-02/>, as of March 10, 2010]; Frederick, *America's Water Supply: Status and Prospects for the Future* (Consequences, vol. 1, No. 1, Spring 1995) [< http://www.gcrio.org/CONSEQUENCES/spring95/Water.html>, as of March 10, 2011].)

[4] " 'Significant effect on the environment' means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance." (Guidelines, § 15382.)

avoid the combined direct, indirect and cumulative effects of the substantially changed groundwater baseline conditions and LOWRF project on groundwater quantity and quality.[5] Consistent with CEQA, we thus request public review in an SEIR of (1) the major change in physical baseline conditions affecting groundwater sustainability represented by the significantly increased saltwater movement into the basin; and (2) the combined environmental effects (including public health effects) of this change and the LOWRF project, including the relationship of the change to -- and the cumulative effects thereof on -- the changes in aquifer dynamics and freshwater storage that result from the implementation of the LOWRF project. SEIR assessment of the seawater intrusion impacts of the LOWRF project and of the comparative impacts of feasible wastewater treatment alternatives must be performed, and mitigation measures correlated to the actual severity of the impact (the real, anticipated salinity levels and their distribution) must be developed and implemented, based on specific, measurable, enforceable and verifiable performance standards. This SEIR assessment is critical to informed decisionmaking and public participation in the WDRs review and approval process. The post-2009 EIR information now available to the CCRWQCB negates the assumptions of hydrogeological and hydrochemical equilibria in baseline water conditions upon which the County EIR assessments and mitigations were based. Under those circumstances, should the CCRWQCB approve the WDRs, CEQA mandates preparation of an SEIR so the CCRWQCB and the public may be adequately informed of relevant, substantial or potentially substantial adverse environmental effects of the LOWRF project, considered in the *actual,* full hydrogeological and hydrochemical context, and based on *current* hydrogeological and hydrochemical data and environmental assessment using modeling that accounts for appropriate margins of safety.

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[5] "Clean groundwater" is one of the three central tenets of the CCRQQCB's healthy watersheds vision, which, as cogently stated on the CCRWQCB's Website, serves "to empower people to act on the important issues facing the Central Coast Region over the next 20 years." (<http://www.swrcb.ca.gov/centralcoast/publications_forms/ publications/vision/teams.shtml> [as of March 10, 2011].) Substantially accelerated seawater intrusion in the Los Osos Valley groundwater basin surely is one such issue. Because this hydrogeological process occurs in the area affected by the LOWRF project, it cannot be severed from the CCRWQCB's review of the WDRs. CEQA requires that physical baseline conditions affected by a project be disclosed in the environmental review document of the agency called upon to take permitting action for that project. As provided in Guidelines section 15125, subdivision (c): "Knowledge of the regional setting is critical to the assessment of environmental impacts. *Special emphasis* should be placed on environmental resources that are *rare or unique* to that region and would be affected by the project. The EIR [or, in this case, an SEIR] must demonstrate that the significant environmental impacts of the proposed project were adequately investigated and discussed and it must permit the significant effects of the project to be considered *in the full environmental context*." (Emphasis added.) Considering its high level beneficial use, the groundwater resource here surely is rare and unique to the region and the population that depends on it. (See also *County of Amador v. El Dorado County Water Agency* (1999) 76 Cal.App.4th 931, 954-955 [for adequate environmental assessment of fisheries, river habitat and recreational use impacts of lake water withdrawals associated with a water supply project, the permitting agency must disclose and evaluate relevant information on baseline lake levels, including rates of existing releases]; CEQA Guidelines, § 15126.2, subd. (a) [EIR should address, inter alia, the "health and safety problems caused by the physical changes, and other aspects of the resource base such as water … and public services"].)

Whenever an agency with discretionary approval authority over a permit or other entitlement for use for a project makes an approval decision, and the final EIR for the project fails to provide the environmental information disclosure mandated by CEQA, or is not supplemented to account for substantially changed circumstances in physical baseline conditions or to review significant new environmental information relevant to the project, the decision is a prejudicial abuse of discretion, and, therefore, a nullity. (See *Communities for a Better Environment v. City of Richmond* (2010) 184 Cal.App.4th 70, 88 [an agency's " 'ultimate decision of whether to approve a project, be that decision right or wrong, is a nullity if based upon an EIR that does not provide the decision-makers, and the public, with the information about the project that is required by CEQA' "]; *Mira Monte Homeowners Assn. v. County of Ventura* (1985) 165 Cal.App.3d 357, 361, 364-365 [failure to prepare an SEIR after resurvey of project site revealed significant new information, i.e., a greater seasonal wetlands impact than previously identified, nullified approval decision because it prevented consideration of "the full range and effectiveness of alternatives and mitigation measures"].)

Importantly, as a responsible CEQA agency, the CCRWQCB cannot defer to the County regarding whether or not to prepare an SEIR. By CEQA, the CCRWQCB must reach its own conclusions on whether and how to approve a project, based not only on its review of the environmental document prepared by the lead agency, but also any new information in an SEIR which the CCRWQCB must prepare where, as here, SEIR review is mandated. (See Guidelines, §§ 15020, 15052, 15096, subd. (a), 15162, 15163; *Save San Francisco Bay Assn. v. San Francisco Bay Conservation and Development Com.* (1992) 10 Cal.App.4th 908, 932; *id*. at 921-922 [responsible agency must "conduct its own analysis using its own special expertise" before "reach[ing] its own conclusions"].) As discussed in greater detail in the attached addendum, Guidelines section 15052 requires the CCRWQCB to step into the shoes of the County, and prepare (or contract preparation of) an SEIR prior to approving WDRs for the LOWRF project, because: (1) the prerequisites under section 21166 and Guidelines section 15162 for an SEIR are established; and (2) prior to the CCRWQCB's action, the lead agency (County) granted a final discretionary approval for the LOWRF project and the statute of limitations for challenging that approval has expired. (County approval occurred on September 29, 2009. The statute of limitations expired in 2009 -- 30 days after the posting of the County's notice of determination which gave public notice of the September 29, 2009 decision.)

Importantly, even absent -- yet especially because of the presence of -- the new physical baseline conditions and the new information summarized above, the CCRWQCB, as a responsible agency, must mitigate or avoid "the direct or indirect environmental effects of those parts of the project which it decides to carry out, finance, or approve." (Guidelines, § 15096, subd. (g)(1).) Also, "[w]hen an EIR has been prepared for a project, the Responsible Agency shall not approve the project as proposed if the agency finds any feasible alternative or feasible mitigation measures within its powers that would substantially lessen or avoid any significant effect the project would have on the environment." (Guidelines, § 15096, subd. (g)(2).) Finally, before approving the WDRs, the CCRWQCB must "make the findings required by [Guidelines] Section 15091 for each significant effect of the project and shall make the findings in [Guidelines] Section 15093 if necessary." (Guidelines, § 15096, subd. (h); see *Save San Francisco Bay Assn.*, 10 Cal.App.4th 908, 921-922, 932.)

The CCRWQCB thus clearly has a duty to mitigate or avoid the adverse impacts of the LOWRF project. The discretionary approval currently before the CCRWQCB involves mitigation for the LOWRF project's impacts to hydrology and water quality. The CCRWQCB staff report asserts that the CCRWQCB has no duty to make specific findings pursuant to Guidelines section 15096, subdivision (h), because the EIR did not identify any potentially significant impacts within the CCRWQCB's jurisdiction. This conclusion is unsupported, in light of both the new information discussed above, and previous information contained in the 2009 EIR itself, which identifies project impacts to federally regulated waters as potentially significant. Those impacts are within the CCRWQCB's jurisdiction. Specifically, construction of pipelines that will be suspended over two federally regulated creeks (Los Osos Creek and Warden Creek) will result in construction impacts to these creeks. As such, the County may have to obtain (a) a Clean Water Act section 401 Water Quality Certification from the CCRWQCB; and (b) a Clean Water Act section 404 permit from the U. S. Army Corps of Engineers, necessary for discharges of dredged or fill material into the federally regulated creeks. Both the staff report and the WDRs fail to describe and evaluate this potentially significant impact. Further, despite the EIR's identification of this potentially significant impact, the WDRs contain no findings regarding the project's effects on federally regulated waters, or potentially feasible alternatives or mitigation measures which would avoid or substantially lessen the effects.

In any event, given the changed water baseline conditions and the new information that has become available following certification of the 2009 EIR, the CCRWQCB must do more than prepare findings tracking the requirements of Guidelines section 15096, subdivision (h). It must prepare and circulate an SEIR, and explore and impose (following public review of the SEIR) feasible mitigation measures or a feasible alternative to the LOWRF project as proposed. Regardless of bureaucratic or political momentum behind the County's project, the next responsible agency must follow the law. It cannot simply defer to the lead agency without assuming its own CEQA duties, including its duties under section 21166 and Guidelines sections 15052, 15162 and 15096.

<u>The WDRs Unlawfully Defer Environmental Review Regarding Location and Impacts of Discharges from the LOWRF Project.</u>

The CCRWQCB staff report states that the County "included a list of areas proposed for disposal in its report of waste discharge application." (Staff report at 2; proposed WDRs at 2.) But these areas remain unspecified, and the list is not disclosed, let alone discussed in the staff report or the WDRs. The list appears to be nonbinding anyway. We are told, indeed, that "Details of the Discharger's reuse program are not yet available[,]" and that the reuse program has yet to be developed. (*Id.*)[6] The long and the short of it is: except for the Broderson leach field (Discharge

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[6] The staff report and the proposed WDRs, by use of four separate bullet points, confusingly refer to four separate "discharge points," as follows:

> "• Discharge Point 1: Agricultural reuse irrigation at 25 different locations.
> "• Discharge Point 2: Broderson leach field.
> "• Discharge Point 3: Bayridge Estates leach field at 2 locations.
> "• Discharge Point 4: Urban reuse irrigation at 10 different locations."

Point 2) and (perhaps) the two locations of the Bayridge Estates leach field (Discharge Point 3), the CCRWQCB is being requested to approve WDRs for many unspecified discharge locations, that is, without knowing where much of the wastewater the discharges of which it must permit will be discharged.

This is a startling request, as is the gap in information regarding where wastewater discharge impacts will occur, and thus what their onsite and their offsite (runoff) effects will be. The informational gap precludes assessment of water quality impacts, which is key to the CCRWQCB's decision on the WDRs. Moreover, the list of proposed disposal areas in the WDRs omits identification of any discharge location consistent with County condition of approval No. 97, which requires at least 10 % of the treated wastewater to be reserved for environmental enhancement, including the protection of local Environmentally Sensitive Habitat Areas.

Knowledge of the specific wastewater discharge locations is of the outmost importance, especially because recycled wastewater is not contaminant free. (See, e.g., Comments of Edo McGowan, attached as exhibit 1.) It contains antibiotic resistant genes (ARGs) and contaminants of emerging concern (CECs). CECs include persistent organic pollutants (e.g., chemicals used in flame retardants; pharmaceuticals and personal care products; veterinary medicines; endocrine-disrupting chemicals (e.g. synthetic estrogens and androgens affecting hormonal functions in aquatic organisms); and nanomaterials (e.g., carbon nanotubes). (See U.S. E.P.A. OW/ORD Emerging Contaminants Workgroup, *Aquatic Life Criteria for Contaminants of Emerging Concern* (June 3, 2008), attached hereto as exhibit 2, at 2.) Numerous scientific articles and studies have investigated both CECs and ARGs in treated wastewater and have documented the health risks they pose to humans and wildlife -- addressing, for example, limb malformations and behavioral abnormalities, decreased reproduction, increased susceptibility to predation, and increased vulnerability to parasites, disease and UV radiation in amphibians and fish. (See *id.*; Petrovic, et al., *Analysis and Removal of Emerging Contaminants in Wastewater and Drinking Water* (2003), attached hereto as exhibit 3, at 3-5; Pruden, et al., *Antibiotic Resistance Genes as Emerging Contaminants: Studies in Northern Colorado* (2006) 40 Envtl. Science & Technology 7445, attached hereto as exhibit 4, at 1.)

The Porter-Cologne Water Quality Control Act requires identification of all discharge locations before the WDRs may be approved. By Water Code section 13263, the CCRWQCB must "prescribe requirements as to the nature of any proposed discharge . . ., *with relation to the*

(*Id*.) Evidently, 25 unspecified locations for agricultural reuse irrigation plus ten unspecified locations for urban reuse irrigation amounts to more than four discharge points. The staff report and the WDRs also reference as an attachment a barely legible map which shows several tiny squares scattered throughout an approximately six-square mile area, vaguely suggesting some of the reuse locations, all without indicating what agricultural lands or urban properties are being referenced, what they are being used for (e.g., turf at local schools, presenting risks of human contact with wastewater?), or whether their needs for recycled water are actually unmet. The map is vaguely illustrative and nonbinding at best. It does not refer to any specific selected wastewater discharge locations. That much is clear from the staff report.

conditions existing in the disposal area or receiving waters upon, or into which, the discharge is made or proposed." (Water Code, § 13263, subd. (a), emphasis added.) The plain language of this statutory provision makes clear that for the CCRWQCB to be able to prescribe WDRs as to the nature of any discharge proposed by the County, disclosure and analysis of site-specific baseline conditions at the discharge locations is necessary. The Legislature did not intend for regional water quality control boards to prescribe requirements "*with relation to* conditions existing in the disposal area" (Water Code, § 13263, emphasis added), without informing themselves, disclosing and evaluating those conditions.

The conditions existing in the disposal area or receiving waters impacted by proposed discharges are the physical baseline conditions affected by a project subject to WDRs. Therefore, CEQA, too, requires that the CCRWQCB identify the wastewater discharge locations. (See *Communities for a Better Environment v. South Coast Air Quality Management Dist.* (2010) 48 Cal.4th 310, 321 ["the impacts of a proposed project are ordinarily to be compared to the actual environmental conditions existing at the time of CEQA analysis, rather than to allowable conditions defined by a plan or regulatory framework"; thus, "the baseline for CEQA analysis must be the 'existing physical conditions in the affected area' [citation], that is, the ' "real conditions on the ground" ' [citations]"]; *County of Amador*, 76 Cal.App.4th 931, 952 ["It is only against [the] baseline [of the existing environmental conditions] that any significant environmental effects can be determined"]; *Sundstrom v. County of Mendocino* (1988) 202 Cal.App.3d 296, 308-309.)

In *Sundstrom*, the project applicant wanted to build a motel which necessitated the construction of a private sewage treatment plant. The mitigated negative declaration for the project included a requirement that the applicant obtain approval of a sludge disposal plan from the regional water quality control board, but did not disclose the sludge disposal location. The appellate court held that by dismissing the impact as insignificant without disclosure of a suitable sludge disposal site, the permitting agency failed to comply with CEQA.

A related CEQA issue pertaining to the LOWRF project's recycled water program arises out of the proposed condition that the County "develop an Engineering Report on the Production, Distribution and Use of Recycled Water" for later review and approval by the CCRWQCB's Executive Director. (WDRs at 13; CCRWQCB staff report at 4.) But environmental review and approval of the production, distribution and use of recycled water -- an integral element of the LOWRF project -- cannot be so segregated from the project, deferred to the future and delegated away by the permitting agency's decisionmaking body. As *Sundstrom* explains, at page 307:

> "A study conducted after approval of a project will inevitably have a diminished influence on decisionmaking. Even if the study is subject to administrative approval, it is analogous to the sort of post hoc rationalization of agency actions that has been repeatedly condemned in decisions construing CEQA."

Should the CCRWQCB not wish to conduct SEIR review, which would adequately inform its decision on the WDRs, it has the option of denying the WDRs outright. (See § 21080, subd. (b)(5) [an agency's rejection of a project is exempt from CEQA review].) As a responsible agency under CEQA, the CCRWQCB may indeed "refuse to approve" the WDRs "to avoid direct or indirect environmental effects of that part of the project which [as the] responsible agency [it is] called on to

carry out or approve." (Guidelines, § 15042.) However, if the CCRWQCB does not choose such course of action, the environmental issues raised above and those identified in our addendum (and supporting attachments) must be addressed and resolved in an SEIR. An SEIR should consider in-depth reasonable alternatives, including a septic tank effluent pumping system or other alternatives and mitigation measures that more effectively avoid or minimize the environmental impacts of the LOWRF project as currently proposed, while demanding substantially less public funding (and hence less economic burden on the community that must pay for it).

ANGEL LAW

Frank P. Angel

Enclosures

cc: Harvey Packard, Section Manager (hpackard@waterboards.ca.gov)

Exhibit 1

3/1/11 Bd Mtg. Item 5
Los Osos
Deadline: 2/22/11 by 12 noon

commentletters - 3/1/2011 BOARD MEETING

From: Edo McGowan <edo_mcgowan@hotmail.com>
To: <commentletters@waterboards.ca.gov>, <mkeeling@waterboards.ca.gov>, <edo...
Date: Monday, February 21, 2011 2:16 PM
Subject: 3/1/2011 BOARD MEETING
Attachments: antibiotic resistance.jpg; antibiotic resistance-SB.jpg

RECEIVED
FEB 22 2011
SWRCB EXECUTIVE

To: SWRCB & SLO RWQCB, Comments on Item #5 **3/1/2011 BOARD MEETING**

Re: Clerk to the Board at commentletters@waterboards.ca.gov. "**3/1/2011 BOARD MEETING**

DIVISION OF FINANCIAL ASSISTANCE

Item #5

Consideration of a proposed Resolution authorizing funding from the Clean Water State Revolving Fund (CWSRF) to the County of San Luis Obispo Los Osos Wastewater Project (Project), CWSRF Project No. C-06-5230.

The Project will offset potable water use in the Los Osos Groundwater Basin (Groundwater Basin) with California Title 22 disinfected, tertiary-treated recycled water. Recycled water will be **used for urban** and **agricultural irrigation** at sites that currently rely on potable water.

Comment: 1)The moneys allocated to this project should include testing for antibiotic resistant genes (ARGs) in the finished disinfected Title 22 recycled water. If this can not be done because the water is as yet unavailable, a surrogate test could be conducted on similar systems producing this water around the state for ARGs. Sewer plants that are proposed for preparation of recycled water must be capable of also removing CECs and ARGs from the finished product. This is currently not often the situation, thus: 3) Title 22 recycled water as typically produced represents a potentially cumulative and unnecessary adverse impact on human and environmental health.

This comment is is intended to be detailed so that the critical information information is available to the State and Regional Boards and their respective staff, thus allowing for a thoughtful development of policy and regulatory controls on the subject project. Antibiotic resistance is now a fact of life and thus it will be important for the boards and their staff to have some acquaintance with the subject. This is especially critical because the currently designed sewer plants generate the production of antibiotic resistant organisms which are then discharged in large numbers into the environment.

Fm: Dr Edo McGowan, Medical Geo-hydrology, Medical Hydropathology Working Group

The subject of antibiotic resistance, as discussed herein, is important for several reasons. Both human and veterinary medicine are expending considerable resources nationally in attempting to control the accelerating rates of antibiotic resistance. At the same time, resistance is rapidly destroying the remaining antimicrobial drugs that currently exist. To add insult to injury, the pharmaceutical industry seems disinterested in investing in new antimicrobials. Thus the tools available to medicine are diminishing. Concomitantly, the sewer plants, as currently designed and operated are releasing large volumes of antibiotic resistant microbes into the environment, thereby sabotaging the efforts of both human and veterinary medicine to control antibiotic resistance and consequently sewer plants and their byproducts are endangering public health and herd health.

That sewer plants as currently designed and operated do generate and discharge antibiotic resistant bacteria is beyond dispute. The Wastewater Research Division, Municipal Environmental Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio, conducted a protracted study on the ability of currently designed sewer plants to generate antibiotic resistant bacteria, which are then discharged. This US/EPA study was conducted in the late 1970s and reported in the early 1980s. The report based on the US/EPA study (1982) cited former studies reaching back another decade into the past and these cited studies said the same thing. Thus, although the information could hardly be considered as new, i.e., it has been around for nearly 4-decades, it seems not to have worked itself into the regulatory processes that control sewer plants. Since the State is **prime** for purposes of the Clean Water Act, it is time for the State and its Regional Boards to recognize this shortcoming, hence the need for the detail in this comment. Here is some extracted text from the report of the study conducted by the US/EPA:
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC241834/pdf/aem00183-0119.pdf

"Several researchers have pointed out that wastewater, treated or untreated, is a primary contributor of bacteria to the aquatic ecosystem (12, 16, 17, 20, 27, 29). Studies have been conducted which demonstrate that significant numbers of multiple drug-resistant coliforms occur in rivers (17), bays (9), bathing beaches (28), and coastal canals (13). Waters contaminated by bacteria capable of transferring drug resistance are of great concern since there is the potential

for transfer of antibiotic resistance to a pathogenic species.

When bacteria which carry transmissible R-factors (R+ bacteria) are ingested by a human host, the R-factors may transfer into commonly occurring bacteria of the gastrointestinal tract (32). These organisms may subsequently transfer this resistance to pathogenic organisms, resulting in reduced efficacy of antimicrobial chemotherapy in the event of an infection. In vivo studies have shown that when individuals carrying R+ bacteria are subjected to antibiotic therapy, py, these organisms flourish and transfer their resistance to other bacteria (25)."

12. Geldreich, E. E. 1972. Water-borne pathogens, p. 207-241. In R. Mitchell (ed.), Water pollution microbiology. Wiley-Interscience, New York.
16. Grabow, W. O. K., O. W. Prozesky, and L. S. Smith. 1974. Drug-resistant coliforms call for a review of water quality standards. Water Res. 8:1-9.
17. Grabow, W. O. K., M. VanZyl, and O. W. Prozesky. 1976. Behavior in conventional sewage purification processes of coliform bacteria with transferable or non-transferable drug resistance. Water Res. 10:717-723.
20. Linton, K. B., M. H. Richmond, R. Bevau, and W. A. Gillespie. 1974. Antibiotic resistance and R-factors in coliform bacilli isolated from hospital and domestic sewage. J. Med. Microbiol. 7:91-103.
27. Smith, H. W. 1970. Incidence in river water of Escherichia coli containing R-factors. Nature (London) 228:1286-1288.
29. Sturtevant, A. B., Jr. and T. W. Feary. 1969. Incidence of infectious drug resistance among lactose-fermenting bacteria isolated from raw and treated sewage. Appl. Microbiol. 18:918-924.

Project (No. C-06-5230)

The project (No. C-06-5230) discusses both municipal irrigation with recycled water and also the use of that water on agricultural lands. This comment will first discuss the use in agriculture. Following that will be a discussion on the use in municipal irrigation and accompanying human health issues. Additional attention should be accorded to the area of effluent discharge, i.e., the location and length of the outfall, the currents and tides and thus the ability for the outfalled sewage effluent to contaminate coastal areas and beach sands. To illustrate this effect, a separate note discussing the Montecito Sanitary District's outfall is attached at the end of this comment.

AGRICULTURE

It is necessary to discuss how irrigation with Title 22 recycled water may impact both the food produced, hence human health and also impact the underlying agricultural base that produces such food. It is well established that the food borne disease outbreaks in the Salinas Valley, through media attention, had badly crippled the area's income, even for farms not even connected with the problem. Nonetheless, the "problem" became a widespread economic disaster.

It is also well established that current water quality tests used by the State of California fail to reflect the actual presence of pathogens often found in the finished and disinfected Title 22 recycled water. This fact is amply demonstrated by the 2004 study by WERF (00-PUM-2T). The essence of that report's findings may be summed by the following sentence: "The failure of measurements of single indicator organism to correlate with pathogens suggests that public health is not adequately protected by simple monitoring schemes based on detection of a single indicator, particularly at the detection limits routinely employed."

This failure is also reflected by my work with finished disinfected Title 22 recycled water tested at two separate sewer districts, in which water we found multi-antibiotic resistant bacteria, see attachments which are photographs of disc diffusion tests of the recycled water showing the extent of the resistance. If you are unfamiliar with reading these test results, please do not hesitate to contact me for assistance. In the case of the finished Title 22 recycled water produced by the El Estero plant, the bacteria were resistant to 11 of the 12 challenge antibiotics. Water from the Goleta plant demonstrated resistance to 4 of the 12 test antibiotics. Unless there are some uncharacteristic factors related to these two plants that produce recycled water per state criteria that make them different from all other plants within the state, we should also find these results generally in most other plants that use these same criteria.

When this water is used to irrigate crops consumed raw, the bacteria and their genetic fragments can, through the consumption of the produce, be transferred to the human gut biota. These resistant bacteria and their genes are able to thus impact both the internal commensal (gut) biota and immune system.

Sjolund (2005) has found that once in the gut, the genetic material has a very long residence life, years. Additionally, once ingested, the plasmids may be transferred to and through normal flora into pathogenic bacteria found in humans or animals, making later treatment with particular antibiotics ineffective (US/EPA also noted this transfer). Additionally, one must consider that the transfer of genetic information from these organisms to more robust organisms might contribute to increased resistance in higher-grade pathogens by interspecies transfer. Sjolund et al go on to note that since populations of the normal biota are large, this affords the chance for multiple and different resistant variants to develop. This accordingly enhances the risk for spread to populations of pathogens. Consequently, by the use of sewage generated recycled water, as currently produced, there is a revolving door between the human population and the sewer plant, especially when foodstuffs are locally grown and consumed when raised on recycled water that is improperly treated.
What goes on food crops which are consumed raw can have long lasting effects. When humans defecate there is production of a fecal veneer around the anal skin. Thus the fecal veneer forming on the perineum would see colonization of adjoining orifices. There are recent studies on vaginal flora were females who had no contact with antibiotics were found with vaginal flora containing drug resistant bacteria. For the pregnant female, this may place the pregnancy at risk, especially if *Listeria monocytogenes* is found in water and soil. According to the Center of Disease Control (CDC), an estimated 2,500 persons become seriously ill each year with *Listeria monocytogenes* in the United States and among these, 500 will die. According to research, pregnant women account for 27% of these cases. CDC claims that pregnant women are 20 times more likely to become infected than non-pregnant healthy adults.
Vegetables can become contaminated from the soil, especially of the bacteria are brought in with the irrigation water. Such an inner connected series as irrigation with recycled water, contamination of crop, consumption of crop, transfer of resistance to gut, movement to fecal veneer, and establishment of resistant contamination in vaginal flora as described immediately above would provide but a single example for project No. C-06-5230, without adequate controls, to become a public health risk.

It is important to understand that there are two basic types of antibiotics with which medicine (human or veterinary) work: bacteriostatic and bacteriocidal. A good primer on this difference has been produced by the National Foundation for Infectious Disease and may be found at http://www.nfid.org/pdf/id_archive/antibiotictherapy.pdf.

Examples:

Bactericidal Drugs: Streptomycin, Sulfonamides, Aminoglycosides
Bacteriostatic Drugs: Tetracycline, Penicillin, Chloramphenicol

Many antibiotics are bacteriostatic and thus merely arrest the growth of bacteria but do not kill them, that job is left for the immune system. But if the immune system is also disrupted by, for example diabetes, and then hit with a chlorine-resistant bacteria, the job of quelling infections, hence the job of medicine, becomes far more complicated. The immune system is designed to produce a chlorine-like material used by the white blood cells to kill bacteria. But if these bacteria are chlorine resistant, this greatly challenges the immune system. If that immune system is already compromised: the very young, the very old, the diabetic, those on immune supressors, etc., the job of medicine is much increased.

Perhaps the case of methicillin resistant *Staphylococcus aureus* (MRSA) is an apt example. MRSA, out of all the various drug resistant pathogens, by itself, now kills more Americans than AIDS, this according to the CDC. Matt Wook Chang (see abstract below), in studying the response of bacteria to chlorine is finding that chlorine up-shifts the capacity of pathogens to cause disease by causing induction of major *virulence* genes. In working with methicillin resistant *Staphylococcus aureus* (MRSA), Chang finds that virulence genes are up-regulated by exposure to chlorine. This response is not limited to this one pathogen but is widely seen amongst bacteria. Dr Marlyn Roberts is finding MRSA along beaches and this issue of beach sands will be discussed later in this document. It is important to note, however, that beach sands offer an excellent medium for the growth and sustenance of pathogenic bacteria.

Thus although pathogens that might otherwise seldom meet in nature to exchange genetic information, upon entering sewer plants are finding themselves forced into close contact within these sewer plants with high levels of gene exchange and then exposed to chlorine. In this situation, the opportunities for development of both enhanced resistance and virulence are elevated. Because bacteria under stress can also enter a dormant state that is not visible to the standard tests, they are missed in the single indicator tests typically used in testing recycled water. This dormant state is called viable but non-culturable (VBNC). WERF has published on this dormant state and has shown that the standard tests used in wastewater and for wastewater byproducts may substantially under represent actual bacterial numbers **by several magnitudes**. Thus, in these conditions, which are common, the standard test results are giving false negatives and thus failing to serve their role in public health protection. We have noted this VBNC when we test finished Title 22 recycled water with the state approved MPN test. When we tested finished disinfected Title 22 recycled water just as it leaves the plant and again at the point of use we got dramatically different results. If we test just as the water is leaving the plant, we get non-detect or very low numbers with this standard testing procedure. When, however, we test this same water with the same test procedure at the point of use the numbers are often quite high and at times completely off the chart. We feel that this dramatic difference is related to resuscitation of bacteria in the VBNC state. It could also reflect the shedding of biofilms. Testing would help differentiate these two potentials. Personally, I think it is both and once the delivery system has an established biofilm that is shedding, the issue of public health is exacerbated. In using the disc diffusion tests as compared to the single indicator MPN test at both point of release and point of use, we get multi-antibiotic resistant bacteria. Thus the standard single indicator tests are not reflecting reality.

Some sewer plants producing recycled water are also using UV light as a disinfectant. There are flaws with this process that warrant some discussion. As noted in the 1982 report from the US/EPA study that demonstrated generation of antibiotic resistance by sewer plants, it will be noticed that UV not only enhanced antibiotic resistance but failed to kill up to 40% of certain

target bacteria. More recently in discussion with Dr. Amy Pruden who works with ARGs, it was mentioned that in close examination of UV disinfection results, although the bacteria were killed, the critical DNA that conferred resistance was not affected. If one were to review the 1928 work of Dr Fred Griffith, it will be found that live bacteria can extract genetic information from heat-killed bacteria.Thus merely killing bacteria with UV is insufficient for public health purposes.

This observation, the non destruction of DNA by UV, by Dr. Pruden is a significant finding because there is a strong reliance on UV in some systems. Dr. Pruden also notes that ARGs are unaffected by chlorine at levels typically used in water quality control and are so small that they will pass through typical filtering systems used by water treatment plants. Consequently, there is the opportunity to see ARGs and gene fragments, which are not amenable to the standard tests, making it through treatment works into the environment. Dr. Pruden is set up to test water samples for ARGs and it is suggested here that the State and thus its Regional Boards contact Dr Pruden to discuss testing of recycled water for ARGs. She may be reached through her university number at (540) 231-3980.

Antibiotic resistant genes that are common to reclaimed water are now also found in drinking water. The fact that sewer plants are generators of antibiotic resistant pathogens whose genes are generally easily taken up and multiplied by the gut biota is an area needing recognition by both the Stare and regional Boards and their respective staff. The ARGs, as I have previously noted, are so small that they pass through many types of filters normally used in water treatment and are not affected by chlorine levels typically used in water treatment. This fact then needs to be inculcated with standards and conditions for permitted uses. For example, if one were to examine the files at the SLO office for the plant in Monterey producing recycled water for the Salinas area, it might be noted that the filters (at least one) was being pushed at 150% of its rated capacity. This over-charge of the filter may well see ARGs moving through the system in large numbers. But based on current standardized tests, that would never be noted, even though the issue of ARGs and health are not disconnected.

The current standards also use proxy or surrogate tests to ascertain water quality. These proxy tests offer a template approach where the template is overlain on the system and if there is a fit, it is assumed that the water is safe. That template related to water clarity and coliform numbers is flawed. The Pomona virus study and its analysis discuss some of these surrogate tests related to water clarity and coliform numbers. In its discussion of this the State itself notes that there is no scientific basis for the reliance on this proxy test. Nonetheless, the regulatory community continues to allow the use of these tests. Much new scientific information has been brought forward since the Pomona study. Additionally, the stakes are now much higher because we are not only losing the battle with antibiotic resistant organisms, but the standards do not consider ARGs, thus there is a serious need to reappraise the tests which underlay the standards.

When we discuss the use of recycled water for irrigation of crops, it is important to understand that crops can internalize bacteria and thus no amount of washing at the kitchen sink has effect on such internalized bacteria. This internalization of bacteria was demonstrated in the 2002 Rutgers University study (see abstract below).

In the case of resistant bacteria and their genes, the bacteria can also interact with the soil commensal biota thus their containment within the soil in which the crops are grown becomes a reservoir for pathogens. This allows for a standing body of bacteria that can enter the roots, thus transferring to the edible portions. As shown by Chad Kinney (see abstract below) certain pharmaceuticals can accumulate in soils and these pharmaceuticals have been shown to be brought in with the recycled (reclaimed) water. The accumulation allows for two detractors, one is the eventual buildup of antibiotics like erythromycin to levels that may key off the development or maintenance of resistance and also, as CECs, may themselves be taken into the crop.

As currently designed and thus operated, many sewer plants can not effectively remove materials in solution. That this is a well documented fact may be seen by the pharmaceuticals now found in the water resources of this nation. There are ways around this with different available technology. That technology can be discussed in a different venue and I am pleased to do so.

A lot of food is now being irrigated with reclaimed sewer water. The State of California allows reclaimed water to be used on crops consumed raw. If this water were properly treated, that would not be a problem. Unfortunately, under current standards and the way sewer plants are designed and run, it can not be properly treated. Thus, leafy greens coming out of ag production areas may be highly suspect, this includes the certified organic. The abstracts below will give you some idea of this issue. Thus while the water may meet standards, it is by no means necessarily safe.

There are provisions in law which allow the Regional Boards to develop standards in areas not covered by current standards. Thus the discussions within this comment document are intended to provide an impetus toward the setting of corrective standards by the boards themselves where the CDPH has not entered the area and where there is a crying need for such standards.

My group is running tests on finished disinfected Title 22 recycled water and finding multi-antibiotic resistant bacteria in the finished product that goes on crops consumed raw. Additionally, as noted above, crops can internalize bacteria and thus no amount of washing at the kitchen sink has effect. Additionally, the plants can internalize pollutants, some of which will biomagnify, i.e., become concentrated within the plants. For example, if a field has too much organochlorine pesticide, one need only plant carrots to clean the soil. The carrots extract the pesticide and bioaccumulate it within the plant's tissues. This is the process called phytoremediation and it is a highly developed and scientifically validated process used globally. We did some of the initial work on developing this process when I was a grad student in the early 1970s at the Environmental Toxicology Department at UC Davis. We tested this with dieldrin and carrots.

Typical sewer plants do not do well with materials in solution and even RO has considerable difficulty in removing flame retardants and about 5% of these materials are found to move through RO. Additionally, certain antibiotics are also not removed by RO and there are recorded failure rates of 20%—this also assumes that these membranes are kept in pristine condition.

Interestingly, the systems that use reclaimed water for crop irrigation do not even go the the extent of using RO.

Chad Kinney, et al (2005) has demonstrated that soil irrigated with recycled water will accumulate pharmaceuticals. These then may biomagnify within the crop grown in that soil.

As to the biomagnification of endocrine disrupters in crops, this is again amply demonstrated in the literature. We do know that endocrine disrupters found in discharged wastewater can, and have, impacted several animal species, birds, fish, amphibians, and worms. Thus, there is potential but unknown impact on humans, especially as such would relate to fetal and first trimester development. Consequently by irrigating crops with recycled water with entrained endocrine mimics and antibiotic resistant microbes, including their genes, the public is being essentially put into a large unauthorized and potentially unethical human experiment.

The levels of endocrine mimics found in recycled water used to irrigate crops must be considered. Bacteria are not the only thing that may be taken into the plants and moved into the edible portions.

IRRIGATION OF MUNICIPAL GREENSCAPE

When this water is used to irrigate greenscape, many of the above discussed problems arise. The bacteria and their genetic fragments can, through the contact, reach the mouth and then enter the human gut biota, moving therefrom to body orifices. As we have seen above, these resistant bacteria and their genes are able to thus impact both the internal commensal (gut) biota and immune system.

Rusin and Gerba have published on finger to mouth transfer of pathogens, see abstracts below. With sprinkler irrigation of recycled water, the aerial transport to off-site surfaces happens and these contaminated surfaces (fomites) allow the transfer of pathogens to humans. There is a good body of literature on sprinkler generation of aerosols that can carry pathogens for considerable distances. The German government has established a set back of 300 meters between sprinklers and habitation. This is not now the case in California where sprinkler irrigation is just across the street from residential neighborhoods. Basum, see below, noted significant drift distances with sprinkler irrigation. This then becomes critical for irrigation around schools and thus on school playing fields where children with immature immune systems are present and have contact with fomites. I think it is not pushing the point to consider the transfer of resistant organisms to school children and then the liability issues that might arise from and to school districts for contamination.

CITATIONS

Sjolund et al. (2005) Emerging Infectious Diseases (Vol. 11, # 9, Sept 2005 @ p. 1389 et seq)

Sara Firl. **The Importance of Municipal Sewage Treatment in the Spread of Antibiotic Resistance**
106th General Meeting of the American Society for Microbiology
May 21-25, 2006, Orlando, Florida. (Session 041/Q, Paper Q-032)

Our study determined that substantial numbers of antibiotic-resistant bacteria were present in municipal wastewater, and that the existing treatment infrastructure did not adequately prevent release of antibiotic-resistant bacteria into the environment.

Validity of the Indicator Organism Paradigm for Pathogen Reduction in Reclaimed Water and Public Health Protection†

Valerie J. Harwood,[1]* Audrey D. Levine,[2] Troy M. Scott,[3] Vasanta Chivukula,[1] Jerzy Lukasik,[3] Samuel R. Farrah,[4] and Joan B. Rose[5]

The validity of using indicator organisms (total and fecal coliforms, enterococci, *Clostridium perfringens*, and F-specific coliphages) to predict the presence or absence of pathogens (infectious enteric viruses, *Cryptosporidium*, and *Giardia*) was tested at six wastewater reclamation facilities. Multiple samplings conducted at each facility over a 1-year period. Larger sample volumes for indicators (0.2 to 0.4 liters) and pathogens (30 to 100 liters) resulted in more sensitive detection limits than are typical of routine monitoring. Microorganisms were detected in disinfected effluent samples at the following frequencies: total coliforms, 63%; fecal coliforms, 27%; enterococci, 27%; *C. perfringens*, 61%; F-specific coliphages, ~40%; and enteric viruses, 31%. *Cryptosporidium* oocysts and *Giardia* cysts were detected in 70% and 80%, respectively, of reclaimed water samples. Viable *Cryptosporidium*, based on cell culture infectivity assays, was detected in 20% of the reclaimed water samples. No strong correlation was found for any indicator-pathogen combination. When data for all indicators were tested using discriminant analysis, the presence/absence patterns for *Giardia* cysts, *Cryptosporidium* oocysts, infectious *Cryptosporidium*, and infectious enteric viruses were predicted for over 71% of disinfected effluents. The failure of measurements of single indicator organism to correlate with pathogens suggests that public health is not adequately protected by simple monitoring schemes based on detection of a single indicator, particularly at the detection limits routinely employed. Monitoring a suite of indicator organisms in reclaimed effluent is more likely to be predictive of the presence of certain pathogens, and a need for additional pathogen monitoring in reclaimed water in order to protect public health is suggested by this study. (Applied and Environmental Microbiology, June 2005, p. 3163-3170, Vol. 71, No. 6)

Lettuce Plants Internalize Bacteria

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Lettuce that has been fertiziled with manure or irrigated with water that is contaminated with *E. coli* O157:H7 can take the bacteria up through its root system and internalize it inside its leaves, resisting traditional external sanitizing methods. Researchers from Rutgers University report their findings in the January 2002 issue of the journal *Applied and Environmental Microbiology*. "In recent years, *E. coli* O157:H7 has been isolated with increasing frequency from fresh produce, including bean sprouts, cantloupes, apples and leaf lettuce. The mechanisms by which the pathogen is introduced into the lettuce plant are not fully understood," say the researchers.

The researchers tested the hypotheses that the source of the contamination may be poorly treated manure (it is estimated that the pathogen is present in over 8 percent of dairy and beef cattle) or irrigation water that has been contaminated with cattle feces. The bacteria were isolated from plants grown using either medium, but interestingly, the researchers found bacteria in the inner tissues of the plants.

"We have demonstrated that lettuce grown in soil containing contaminated manure or irrigated with contaminated water results in contamination of the edible portion of the lettuce plant," say the researchers. "Moreover, the results suggest that edible portions of a plant can become contaminated without direct exposure to a pathogen but rather through transport of the pathogen into the plant by the root system. The inaccessibility of a large number of organisms, as a consequence of their subsurface location, is perhaps the reason for the lack of effectiveness of surface-sanitizing treatments." **(E.B. Solomon, S. Yaron, K.R. Matthews. 2002. Transmission of *Escherichia coli* O157:H7 from contaminated manure and irrigation water to lettuce plant tissue and its subsequent internalization. Applied and Environmental Microbiology, 68: 397-400.)**

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Wastewater Derived Pharmaceuticals In Soil Irrigated With Reclaimed Water

Environmental Toxicology and Chemistry

Article: pp. 317–326 | Abstract | PDF (143K)

PRESENCE AND DISTRIBUTION OF WASTEWATER-DERIVED PHARMACEUTICALS IN SOIL IRRIGATED WITH RECLAIMED WATER

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Three sites in the Front Range of Colorado, USA, were monitored from May through September 2003 to assess the presence and distribution of pharmaceuticals in soil irrigated with reclaimed water derived from urban wastewater. Soil cores were collected monthly, and 19 pharmaceuticals, all of which were detected during the present study, were measured in 5-cm increments of the 30-cm cores. Samples of reclaimed water were analyzed three times during the study to assess the input of pharmaceuticals. Samples collected before the onset of irrigation in 2003 contained numerous pharmaceuticals, likely resulting from the previous year's irrigation. Several of the selected pharmaceuticals increased in total soil concentration at one or more of the sites. The four most commonly detected pharmaceuticals were erythromycin, carbamazepine, fluoxetine, and diphenhydramine. Typical concentrations of the individual pharmaceuticals observed were low (0.02–15 μg/kg dry soil). The existence of subsurface maximum concentrations and detectable concentrations at the lowest sampled soil depth might indicate interactions of soil components with pharmaceuticals during leaching through the vadose zone. Nevertheless, the present study demonstrates that reclaimed-water irrigation results in soil pharmaceutical concentrations that vary through the irrigation season and that some compounds persist for months after irrigation.

Keywords: Pharmaceuticals, Wastewater, Reclaimed water, Soil, Leaching tendencies

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Viability of a low-pressure nanofilter in treating recycled water for water reuse applications: A pilot-scale study

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Abstract

The purpose of this study was to investigate the potential of a low-pressure nanofiltration (NF) membrane for treating recycled water for indirect potable water reuse applications. In particular, the tradeoffs in choosing low-pressure NF over reverse osmosis (RO) were investigated including whether or not significantly lowering operating pressures/costs would result in diminished permeate water quality. A NF membrane (Dow/Filmtec NF-4040) with high permeate productivity was selected for pilot-scale testing over a period of 1200 h at a water reuse facility employing conventional RO membranes for treating tertiary treated wastewater effluent prior to aquifer recharge. The novel application of an NF membrane in treating wastewater effluent for water reuse applications permitted a comprehensive screening of NF permeate water quality and allowed for the investigation of trace organic contaminant rejection on pilot scale with environmentally relevant feed water concentrations. Results from pilot-scale testing highlighted the selectivity of NF membranes in removing organic solutes present in wastewater effluents at the parts-per-trillion level. While operating pressures were by a factor of 2–3 lower than conventional RO membranes, and bulk and trace organic rejection generally exceeded 90 percent, not surprisingly, the rejection of monovalent ions such as nitrate was poor. The poor-to-moderate rejection of monovalent ions, however, resulted in lowered brine stream total dissolved solids concentration and sodium adsorption ratio as compared with the brine stream of conventional RO membranes, which may be beneficial for brine disposal strategies.

Toxicogenomic response to chlorination includes induction of major virulence genes in Staphylococcus aureus

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Abstract

Despite the widespread use of chlorination for microbial control in aqueous environments, cellular response mechanisms of human pathogens, such as Staphylococcus aureus, against chlorination remain unknown. In this work, genome-wide transcriptional analysis was performed to elucidate cellular response of S. aureusto hypochlorous acid, an active antimicrobial product of chlorination in aqueous solution. Our results suggest that hypochlorous acid repressed transcription of genes involved in cell wall synthesis, membrane transport, protein synthesis, and primary metabolism, while amino acid synthesis genes were induced. Furthermore, hypochlorous acid induced transcription of genes encoding major virulence factors of S. aureus, such as exotoxins, hemolysins, leukocidins, coagulases, and surface adhesion proteins, which all play essential roles in staphylococcal virulence. This work implies that chlorination may stimulate production of virulence factors, which provides new insight into host-pathogen interactions and effects of chlorine application for microbial control.

Environmental science & technology 2007, vol. 41, n°21, pp. 7570-7575

J Appl Microbiol. 2002;93(4):585-92.

Comparative surface-to-hand and fingertip-to-mouth transfer efficiency of gram-positive bacteria, gram-negative bacteria, and phage.

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Abstract

AIMS: To determine the transfer efficiency of micro-organisms from fomites to hands and the subsequent transfer from the fingertip to the lip.
METHODS AND RESULTS: Volunteers hands were sampled after the normal usage of fomites seeded with a pooled culture of a Gram-positive bacterium (Micrococcus luteus), a Gram-negative bacterium (Serratia rubidea) and phage PRD-1 (Period A). Activities included wringing out a dishcloth/sponge, turning on/off a kitchen faucet, cutting up a carrot, making hamburger patties, holding a phone receiver, and removing laundry from the washing machine. Transfer efficiencies were 38.47% to 65.80% and 27.59% to 40.03% for the phone receiver and faucet, respectively. Transfer efficiencies from porous fomites were <0.01%. In most cases, M.luteus was transferred most efficiently, followed by phage PRD-1 and S. rubidea. When the volunteers' fingertips were inoculated with the pooled organisms and held to the lip area (Period B), transfer rates of 40.99%, 33.97%, and 33.90% occurred with M. luteus, S. rubidea, and PRD-1, respectively.
CONCLUSIONS: The highest bacteral transfer rates from fomites to the hands were seen with the hard, non-porous surfaces. Even with low transfer rates, the numbers of bacteria transferred to the hands were still high (up to 10(6) cells). Transfer of bacteria from the fingertip to the lip is similar to that observed from hard surfaces to hands.
SIGNIFICANCE AND IMPACT OF THE STUDY: Infectious doses of pathogens may be transferred to the mouth after handling an everyday contaminated household object.

Significance of Fomites in the Spread of Respiratory and Enteric Viral Disease▽

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Worldwide annually there are 1.7 million deaths from diarrheal diseases and 1.5 million deaths from respiratory infections (56). Viruses cause an estimated 60% of human infections, and most common illnesses are produced by respiratory and enteric viruses (7, 49). Unlike bacterial disease, viral illness cannot be resolved with the use of antibiotics. Prevention and management of viral disease heavily relies upon vaccines and antiviral medications (49). Both vaccines and antiviral medications are only 60% effective (39, 49). Additionally, to date there are no vaccines or antiviral drugs for most common enteric and respiratory viruses with the exception of influenza virus and hepatitis A virus (HAV). Consequently, viral disease spread is most effectively deterred by preclusion of viral infection.
Increases in population growth and mobility have enhanced pathogen transmission and intensified the difficulty of interrupting disease spread (14). Control of viral disease spread requires a clear understanding of how viruses are transmitted in the environment (27). For centuries it was assumed that infectious diseases were spread primarily by the airborne route or through direct patient contact, and the surrounding environment played little or no role in disease transmission (19, 27). Up until 1987 the Centers for Disease Control and the American Hospital Association focused on patient diagnosis due to the belief that nosocomial infections were not related to microbial contamination of surfaces (19). Over the years studies have changed the perspective on viral transmission to include a more complex multifactorial model of disease spread (27). There is now growing evidence that contaminated fomites or surfaces play a key role in the spread of viral infections (3, 7, 38, 71).
Viral transmission is dependent on interaction with the host as well as interaction with the environment (60). Viruses are probably the most common cause of infectious disease acquired indoors (7, 71). The rapid spread of viral disease in crowded indoor establishments, including schools, day care facilities, nursing homes, business offices, and hospitals, consistently facilitates disease morbidity and mortality (71). Yet, fundamental knowledge concerning the role of surfaces and objects in viral disease transmission is lacking, and further investigation is needed (52, 60, 61). The goal of this article was to use existing published literature to assess the significance of fomites in the transmission of viral disease by clarifying the role of fomites in the spread of common pathogenic respiratory and enteric viruses.

Comparison of Coliphage and Bacterial Aerosols at a Wastewater Spray Irrigation Site

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Received 24 April 1981/Accepted 22 September 1981
Microbiological aerosols were measured on a spray irrigation site at Fort Huachuca, Ariz. Indigenous bacteria and tracer bacteriophage were sampled from sprays of chlorinated and unchlorinated secondary-treatment wastewaters during day and night periods. Aerosol dispersal and downwind migration were determined. Bacterial and coliphage f2 aerosols were sampled by using Andersen viable type stacked-sieve and high-volume electrostatic precipitator samplers.

Bacterial standard plate counts averaged 2.4 x 105 colony-forming units per ml in unchlorinated effluents. Bacterial aerosols reached 500 bacteria per m3 at 152 m downwind and 10,500 bacteria per m3 at 46 m. Seeded coliphage f2 averaged 4.0 x lo, plaque-forming units per ml in the effluent and were detected 563 m downwind. Downwind microbial aerosol levels were somewhat enhanced by nighttime conditions. The median aerodynamic particle size of the microbial aerosols was approximately 5.0 p.m. Chlorination reduced wastewater bacterial levels 99.97% and reduced aerosol concentrations to near background levels; coliphage f2 was reduced only 95.4% in the chlorinated effluent and was readily measured 137 m downwind. Microbiological source strength and meteorological data were used in conjunction with a dispersion model to generate mathematical predictions of aerosol strength at various sampler locations. The mean calculated survival of aerosolized bacteria (standard plate count) in the range 46 to 76 m downwind was 5.2%, and that of coliphage f2 was 4.3%.

THE FOLLOWING IS PRESENTED TO DEMONSTRATE THAT OUTFALL PLACEMENT MAY HAVE A PROFOUND IMPACT ON BEACH CONTAMINATION.

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Several researchers have pointed out that wastewater, treated or untreated, is a primary contributor of bacteria to the aquatic ecosystem (12, 16, 17, 20, 27, 29). Studies have been conducted which demonstrate that significant numbers of multiple drug-resistant coliforms occur in rivers (17), bays (9), bathing beaches (28), and coastal canals (13). Waters contaminated by bacteria capable of transferring drug resistance are of great concern since there is the potential for transfer of antibiotic resistance to a pathogenic species.

McGowan's abstract.....

Short and shallow marine sewer outfalls, a connection with the spread of antibiotic resistance?

Of the 49 sewer outfalls along the California coast, 17 could be considered as short and shallow which may increase marine and beach sand contamination with antibiotic resistant pathogens. Public beaches adjacent to these short shallow outfalls (SSO) may become reservoirs of antibiotic resistance. Studies of beach sand in lake and marine systems have demonstrated contamination with a variety of pathogens. Some studies specifically considered antibiotic resistant Staphylococcus aureus (MRSA) which now kills more Americans than AIDS, according to the CDC.

Beach-goers who dug in the sand or covered themselves with sand were, in the following week or two, more likely to have diarrheal illnesses from a variety of organisms.

Beach sand, especially if it contains ground kelp, offers a good medium for the regrowth and maintenance of pathogens. Do SSO's augment the contamination of coastal beaches and are the bacteria likely to contain antibiotic resistant genetic material? An answer may be gained by tracking effluent released from SSO's. Pilot data indicate effluent may be returned to the beach and near shore waters.

Sewer plants are a principal source for the generation and release of antibiotic resistant bacteria and their genetic material, per peer reviewed published facts for approximately 40 years. US/EPA also published on the topic in 1982. The California Department of Public Health and the Regional Water Quality Control Boards do not recognize this potentially dangerous situation and consequently have generated no standards for its control.

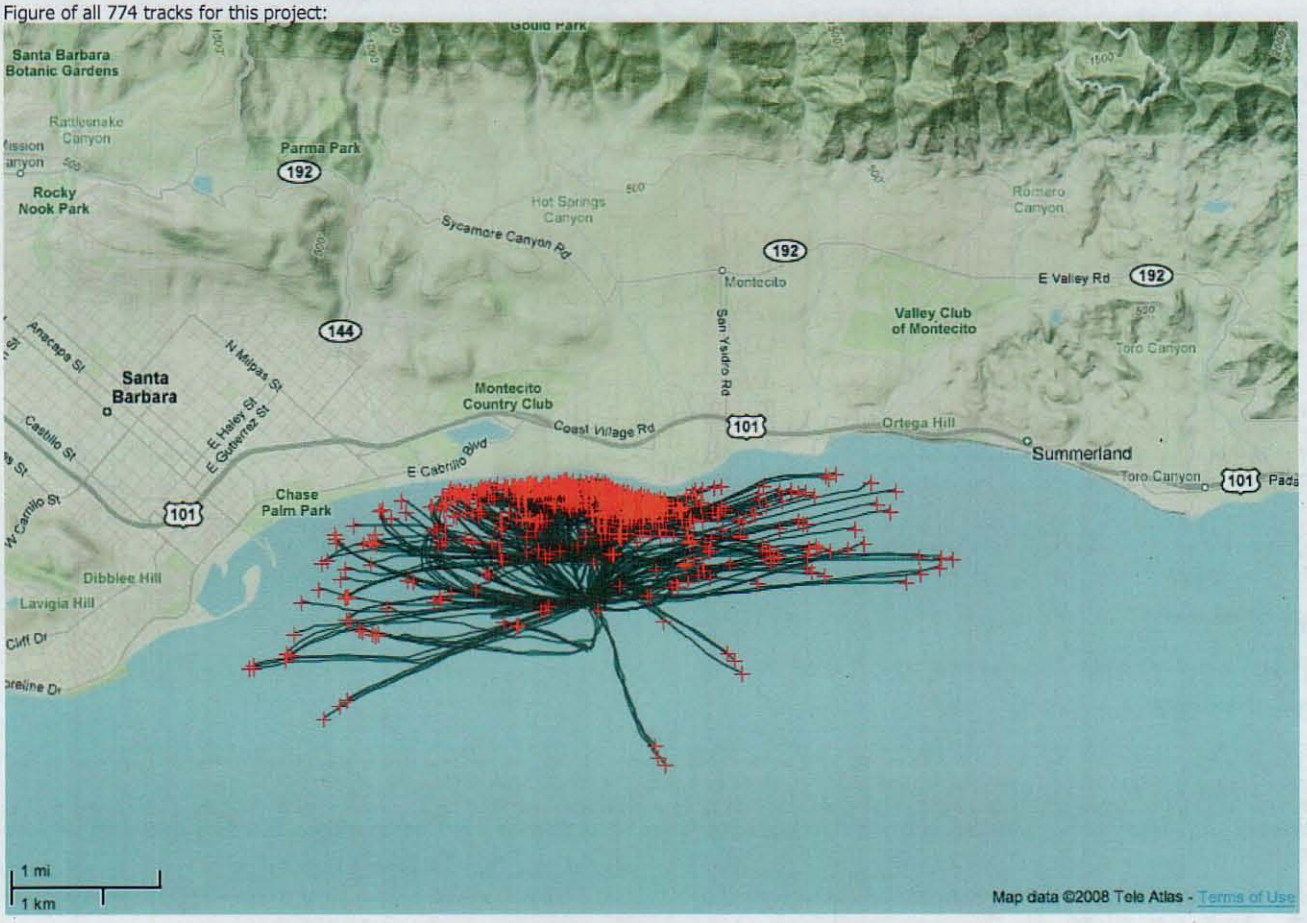
CDC, US/EPA and IATFAR currently plan no research on the subject.

Table of California sewer outfalls which discharge less than ½ mile from shore and depth of less than 40 feet

POTW/WWTP	Miles from shore	Depth in feet
Anchor Bay	0.00	0
Shelter Cove	0.00	0
Fort Bragg	0.12	20
Crescent City	0.13	10
Eureka	0.00	0
Arcata	0.00	0
Half Moon Bay	0.36	37

Daly City	0.47	32
Ragged Pt Inn	0.00	0
Summerland	0.14	20
San Simeon	0.17	20
Avela Beach	0.42	29
Montecito	0.29	35
Carmel Area	0.11	35
Carpinteria	0.19	25
San Clemente Ils	0.00	0
Terminal Ils	0.17	32
Mendecino	0.19	60
Avalon	0.08	130

Figure of all 774 tracks for this project:



Trackers released at the subsurface discharge point of Montecito Sanitary District's sewer outfall showing movement back to beach area and stacking at beach-front. Using these data allows one to argue that released pathogens in the sewage effluent would follow tracker routes. Outfall is 0.29 miles from shore and at a depth of 35 feet. Black lines represent vector of tracker and red + is where tracker stopped its movement.

Exhibit 2

WHITE PAPER

AQUATIC LIFE CRITERIA FOR CONTAMINANTS OF EMERGING CONCERN

PART I

GENERAL CHALLENGES AND RECOMMENDATIONS

Prepared by the
OW/ORD Emerging Contaminants Workgroup

June 03, 2008

NOTICE
THIS DOCUMENT IS AN INTERNAL PLANNING DOCUMENT
It has been prepared for the purpose of Research & Development Planning.
It has not been formally released by the U.S. Environmental Protection Agency and should not at this stage be construed to represent Agency guidance or policy.

DRAFT DOCUMENT

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List of Acronyms:

ACR	Acute to Chronic Ratio
ALC	Aquatic Life Criteria
Ah	Aryl Hydrocarbon (receptor)
AV	Acute (toxicity) value
AWQC	Ambient Water Quality Criteria
CCC	Criterion Continuous Concentration
CEC	Contaminants of Emerging Concern
CMC	Criterion Maximum Concentration
CV	Chronic (toxicity) value
CWA	Clean Water Act
CYP	Cytochrome enzymes (P450)
EDC	Endocrine Disrupting Chemicals
E2	Estradiol (natural estrogen)
EE2	Ethynylestradiol (synthetic pharmaceutical estrogen)
ELS	Early Life-Stage (toxicity test)
EPA	Environmental Protection Agency
FAV	Final Acute Value
FACR	Final Acute to Chronic Ratio
GMAV	Genus Mean Acute Value
GMCV	Genus Mean Chronic Value
HPG	Hypothalamic-Pituitary-Gonadal (axis)
HPT	Hypothalamic-Pituitary-Thyroid (axis)
LOEC	Lowest Observed Effect Concentration
MDR	Minimum Data Requirement
MOA	Mode of Action
NOEC	No Observed Effect Concentration
OECD	Organization for Economic Development and Cooperation
OWC	Organic Wastewater Contaminant
PBDE	Polybrominated Diphenyl Ether
PPCP	Pharmaceutical and Personal Care Product
POP	Persistent Organic Pollutant
SMAV	Species Mean Acute Value
TBT	Tributyltin
USGS	United States Geological Survey
VTG	Vitellogenin protein
vtg	Vitellogenin gene transcript
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

Under the United States Clean Water Act (CWA) (33 U.S.C. Sections 1251-1387), EPA is required to take a number of actions to protect and restore the ecological integrity of the Nation's water bodies. Under Section 304(a) of the CWA, EPA must develop and publish ambient water quality criteria. Ambient water quality criteria (AWQC) are levels of individual pollutants, water quality characteristics, or descriptions of conditions of a water body that, if met, should protect the designated use(s) of the water. Examples of designated uses of a water body include swimming, drinking water, fishing, fish spawning, and navigation. States and authorized tribes establish designated uses for their water bodies. AWQC are recommended guidance that states and tribes may use as part of their water quality standards to protect water bodies for their designated use from chemical pollutants.

AWQC for aquatic life (aquatic life criteria, ALC) developed under Section 304(a) reflect the "latest scientific knowledge" concerning "all identifiable effects" of the pollutant in question. These criteria are based solely on data and scientific determinations on the relationship between environmental concentrations of the pollutant and its effects. Criteria do not consider social and economic impacts, or the technological feasibility of meeting the chemical concentration values in ambient water. Since the early 1980's, EPA has been developing ALC to protect aquatic organisms from chemical specific pollutants under Section 304(a) of the CWA. In 1985, EPA published *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* (hereafter referred to as the "*Guidelines*"; Stephan et al. 1985). The *Guidelines* has provided uniformity and transparency in the derivation methodology of ALC for a large number of compounds among several classes of chemicals. The majority of EPA's currently recommended ALC have been derived using the methods outlined in the *Guidelines*.

While the *Guidelines* remain the primary instrument the Agency uses to meet its broad objectives for the development of ALC, there have been many advances in aquatic sciences, aquatic and wildlife toxicology, population modeling, and ecological risk assessment that are relevant to deriving ALC. Some of the advances have been addressed through supplemental guidance on the derivation or site-specific modification of criteria (Prothro 1993; U.S. EPA 1994a), while others have been incorporated directly into derivation of individual ALC for certain chemicals (e.g., saltwater chronic aquatic life criterion for tributyltin, U.S. EPA 2003). Recently, considerable attention has been generated by a widely ranging group of chemicals termed, in this document, contaminants of emerging concern (CECs). As is discussed in the body of this document, some of these CECs present challenges for the application of the *Guidelines* to ALC development.

1.1 What is a Contaminant of Emerging Concern?

The term "contaminant of emerging concern" is being used within the Office of Water to replace "emerging contaminant," a term that has been used loosely since the mid-1990s by EPA and others to identify chemicals and other substances that have no regulatory standard, have been recently "discovered" in natural streams (often because of improved analytical chemistry detection levels), and potentially cause deleterious effects in aquatic life at environmentally

relevant concentrations. They are pollutants not currently included in routine monitoring programs and may be candidates for future regulation depending on their (eco)toxicity, potential health effects, public perception, and frequency of occurrence in environmental media. CECs are not necessarily new chemicals. They include pollutants that have often been present in the environment, but whose presence and significance are only now being evaluated.

CECs include several types of chemicals:

- Persistent organic pollutants (POPs) such as polybrominated diphenyl ethers (PBDEs; used in flame retardants, furniture foam, plastics, etc.) and other global organic contaminants such as perfluorinated organic acids;
- Pharmaceuticals and personal care products (PPCPs), including a wide suite of human prescribed drugs (e.g., antidepressants, blood pressure), over-the-counter medications (e.g., ibuprofen), bactericides (e.g., triclosan), sunscreens, synthetic musks;
- Veterinary medicines such as antimicrobials, antibiotics, anti-fungals, growth promoters and hormones;
- Endocrine-disrupting chemicals (EDCs), including synthetic estrogens (e.g.,17α-ethynylestradiol, which also is a PCPP) and androgens (e.g., trenbolone, a veterinary drug), naturally occurring estrogens (e.g.,17ß-estradiol, testosterone), as well as many others (e.g., organochlorine pesticides, alkylphenols) capable of modulating normal hormonal functions and steroidal synthesis in aquatic organisms;
- Nanomaterials such as carbon nanotubes or nano-scale particulate titanium dioxide, of which little is known about either their environmental fate or effects.

1.2 Why is EPA Concerned with CECs?

The variety of chemicals labeled as CECs leads to a variety of concerns for EPA. Widespread uses, some indication of chemical persistence, effects found in natural systems, and public concerns have made clear the need for EPA to develop criteria that can be used to help assess and manage potential risk of some CECs in the aquatic environment. A recent U.S. Geological Survey (USGS) reconnaissance study (Kolpin et al. 2002) provides a good example of the prevalence of a wide range of CECs in U.S. streams. Improved analytical chemistry techniques were used to document the occurrence of what the authors called organic wastewater contaminants (OWCs) being released into surface waters from wastewater treatment plants (WWTPs). The targeted OWCs included PPCPs, veterinary medicines and other EDCs. The investigators found at least one of 95 different target OWCs in 80 percent of the 139 streams sampled. A median of seven, and as many as 38, OWCs were found in single samples.

The use and occurrence patterns associated with CECs are varied. Some CECs are similar to conventional toxic pollutants in that they are associated with industrial releases, whereas many others are used by the general public every day in homes, on farms, by businesses and industry (Daughton and Ternes 1999). PPCPs acting as EDCs can be released directly to the environment after passing through wastewater treatment processes, which are typically not designed to remove these pollutants from the effluent (Halling-Sorensen et al. 1998). Sludge from secondary treatment processes are land-applied as biosolids, supplying CECs which may leach or run off into nearby bodies of water. Pharmaceuticals used in animal feeding operations may be released

to the environment in animal wastes via direct discharge of aquaculture products (i.e., antibiotics), the excretion of substances in animal urine and feces of livestock animals, and the washoff of topical treatments from livestock animals (Boxall et al. 2003).

EDCs discharged at WWTPs are one group of CECs with potentially widespread environmental effects (Folmar et al. 1996; Folmar et al. 2001; Jobling et al. 1998; Woodling et al. 2006). Although particular concern has been expressed about the anthropogenic EDCs, there are also natural estrogens (estradiol and its metabolites estriol and estrone) entering the aquatic environment through wastewater discharge and excretion from domestic animals. Furthermore, little is known about the environmental occurrence, fate and, transport for any of these compounds after they enter aquatic ecosystems. Many of the man-made compounds have been in use for a long time, and there is concern about pharmacologically active ingredients and personal care products that are designed to stimulate a physiological response in humans, plants, and animals (Daughton and Ternes 1999).

Frequent detection of compounds by itself does not constitute a need for ALC. Rather, criteria development for CECs needs to focus efforts on chemicals that demonstrate a reasonable potential to adversely affect aquatic life. Of CECs now known to be found in some surface waters of the U.S., EDCs have received the most attention because field studies from around the world have demonstrated that very low concentrations of some of these compounds can significantly impact natural populations of aquatic vertebrates. For example, observational field studies (Jobling et al. 1998) have shown a high occurrence of intersex (the presence of both male and female characteristics) in wild populations of a fish known as roach (*Rutilus rutilus*) in rivers in the United Kingdom that are downstream from WWTPs. Similar results have recently been reported for white sucker (*Catastomus commersoni*) in northern Colorado, U.S.A (Woodling et al. 2006). In a multiyear study by Kidd et al. (2007), the authors showed that environmentally relevant concentrations of ethynylestradiol, EE2, caused reproductive failure and near collapse of a natural fathead minnow population in an experimental lake, and also had deleterious effects on the reproductive biology of the pearl dace. These direct effects resulting in loss of forage fish have led to cascading effects on the lake trout population due to lack of prey (Kidd, personal communication). Researchers from the U.S. Geological Survey (USGS) have observed intersex and testis-ova (the presence of eggs in the testis) in bass species collected from the Potomac River and its tributaries in West Virginia, Maryland, and Washington DC, and also quantified EDCs in their blood (Blazer et al. 2007; Chambers and Leiker 2006). The occurrence of intersex fish in the Potomac River, as well as documented occurrence of this and related effects in other waters of the US and internationally, prompted Congressional hearings that were held in October 2006 to inquire about the "State of the Science on EDCs in the Environment," as well as EPA activities associated with EDCs.

1.3 Purpose and Organization of This White Paper

The purpose of this white paper is to provide general guidance on how criteria development for CECs could be facilitated through a supplemental interpretation of the *Guidelines*, with particular attention to PPCPs with an EDC mode of action (MOA). Section 2 of this part (Part I) of the white paper describes the *Guidelines* procedures and identifies several areas in which these

procedures could be modified to address potential limitations for deriving criteria for CECs. Section 3 expands upon the areas of concern with respect to specific toxicological characteristics of some CECs. Section 4 summarizes these concerns and provides recommendations that could aid in the development of criteria for CECs in a resource efficient manner that takes best advantage of existing knowledge. Part II of this white paper further describes these concerns and recommendations using data for the synthetic pharmaceutical estrogen EE2.

2.0 CURRENT ALC METHODOLOGY

The *Guidelines* specify various data and procedural recommendations for criteria derivation, and also define general risk management goals for criteria, which are to provide a high level of protection for aquatic communities and for important species in these communities. ALC are defined to consist of two concentrations – the Criterion Maximum Concentration (CMC), intended to protect against severe acute effects, and the Criterion Continuous Concentration (CCC), intended to protect against longer term effects on survival, growth, and reproduction. The CMC is used in criteria to limit peak exposures by requiring that 1-hour averages of exposure concentrations not exceed the CMC more often than once in three years on average. The CCC is used in criteria to limit more prolonged exposures by requiring that 4-day averages of exposure concentrations not exceed the CCC more often than once in three years on average.

The CMC and CCC are usually derived from laboratory toxicity test results using specific standard procedures described in the *Guidelines*, but the *Guidelines* also have general provisions for deviating from these procedures as warranted by available information. The following text will first give an overview of the data requirements and calculations in the standard procedures, and then discuss how these procedures might vary under the umbrella of the *Guidelines*.

2.1 Standard ALC Derivation Procedures

The CMC is determined based on available Acute Values (AVs) – median lethal concentrations (LC_{50}s) or median effect (for a severe acute effect such as immobilization) concentrations (EC_{50}s) from aquatic animal acute toxicity tests (48- to 96-hours long) meeting certain data quality requirements. To compute a CMC, the *Guidelines* require that acceptable AVs be available for at least eight genera with a specified taxonomic diversity, in order to address a wide variety of the organisms constituting an aquatic animal community. These minimum data requirements include three vertebrates (a salmonid fish, a fish from a family other than salmonidae, and a species from a third chordate family) and five invertebrates (a planktonic crustacean, a benthic crustacean, an insect, a species from a phylum other than Chordata or Arthropoda, and a species from another order of insect or a fourth phylum).

For each genus, a Genus Mean Acute Value (GMAV) is calculated by first taking the geometric mean of the available AVs within each species (Species Mean Acute Value, SMAV) and then the geometric mean of the SMAVs within the genus. The fifth percentile of the set of GMAVs so obtained is calculated based on a specified estimation method, and designated the Final Acute Value (FAV). The FAV is then lowered to the SMAV for an important, sensitive species if appropriate. The CMC is set equal to half of the FAV to represent a low level of effect for the fifth percentile genus, rather than 50% effect.

The CCC is generally determined based on available Chronic Values (CVs), which are either (a) the geometric mean of the highest no-observed-effect concentration (NOEC) and lowest

observed effect concentration (LOEC) for effects on survival, growth, or reproduction in aquatic animal chronic tests or (b) in some recent criteria (e.g., ammonia), the EC_{20} in such tests based on concentration-effect regression analyses. Chronic tests for invertebrate species are required to include the entire life-cycle, but for fish partial life-cycle and early life-stage (ELS) testing protocols are accepted, the latter not including reproductive endpoints and not used if life-cycle or partial life-cycle tests are available and show more sensitive adverse effects.

If CVs are available for at least eight genera with the required taxonomic diversity, the CCC is set to the fifth percentile of Genus Mean Chronic Values (GMCVs), by the same procedure used to derive an FAV from GMAVs. Otherwise, the CCC is set to the FAV divided by a Final Acute Chronic Ratio" (FACR) that is based on acute to chronic ratios (ACRs – the ratio of the AV to the CV from parallel acute and chronic tests) for at least three species with a specified taxonomic diversity. The CCC can also be based on plant toxicity data if aquatic plants are more sensitive than aquatic animals, or on other data as deemed scientifically justified.

Further details on test requirements and calculation methods for the CMC and CCC are specified in the *Guidelines*, including deriving criteria that are a function of water quality characteristics.

2.2 Alternatives for ALC Derivation

The procedures described above enable broad application to toxic chemicals generally, and are only constrained by specific data requirements for quality and minimum taxonomic representation. Since they are not restricted with respect to specific types of chemicals, there is no reason to suppose that the standard data requirements and procedures specified by the *Guidelines* are any more or less applicable to CECs than to the chemicals for which criteria have already been developed. The *Guidelines* anticipated that rote application of the basic procedures may not yield the most appropriate criteria; consequently, the *Guidelines* provide flexibility when appropriate for deviation from the normal procedures regardless of the type of chemical, as indicated by the following provisions (hereafter referred to as the "Good Science" clauses:

> *"These National Guidelines should be modified whenever sound scientific evidence indicates that a national criterion produced using these Guidelines would probably be substantially overprotective or underprotective of aquatic organisms and their uses on a national basis."* (p. 18).
>
> *"On the basis of all available pertinent laboratory and field information, determine if the criterion is consistent with sound scientific evidence. If it is not, another criterion, either higher or lower, should be derived using appropriate modifications of these Guidelines."* (p. 57).

In addition, although the standard procedures in the *Guidelines* for deriving a CMC and CCC use only toxicity tests meeting certain requirements, the *Guidelines* also mandate the collation and examination of other data that might show effects that should be considered in criteria derivation:

> *"Pertinent information that could not be used in earlier sections might be available concerning adverse effects on aquatic organisms and their uses. The most important of these are data on ... any other adverse effect that has been shown to be biologically important. Especially important are data for species for which no other data are available. ... Such data might affect a criterion if the data were obtained with an important species, the test concentrations were measured, and the endpoint was biologically important."* (p. 54).

While alternatives are allowed when a specific situation dictates, the *Guidelines* still require that any changes in the procedures are consistent with the level of protection represented by the standard procedures:

> *"Derivation of numerical national water quality criteria for aquatic organisms and their uses is a complex process and requires knowledge in many areas of aquatic toxicology; any deviation from these Guidelines should be carefully considered to ensure that it is consistent with other parts of these Guidelines."* (p. iv).

Therefore, for the development of criteria for any chemical, the general strategy should be to start with the standard *Guidelines* procedures and then to adapt those procedures as warranted by available information on the effects of the chemical. This strategy applies to CECs as well, although certain considerations might more consistently be important for CECs. Specific attributes of CECs that might affect criteria derivations are considered in Section 3 of this paper, but several issues are introduced here that are of general concern.

Are data on acute toxicity needed for risk assessments?
Some chemicals are not acutely toxic even at concentrations so high that they could not possibly occur in the environment (e.g., at the chemical solubility, or exceeding exposures possible based on known chemical production and discharges). The acute lethality of some classes of chemicals might be measurable, but would occur at environmental concentrations so much higher than those affecting reproduction, growth, or chronic survival that, in practice, environmental exposures will always be far below acutely lethal levels if those exposures are managed to limit chronic effects. Therefore, derivation of the CMC might be unnecessary or impossible. Thus, if the existing data indicate that it is reasonably certain that acute toxicity would not occur at environmentally relevant concentrations, conducting additional acute tests is likely to be unwarranted.

Even if a CMC is not needed, another use of acute toxicity data is for developing "acute to chronic ratios" (ACRs) that are used with the FAV to calculate the CCC (see pages 40-42 in the *Guidelines*) , so that dropping acute testing requirements must consider this consequence as well. However, if acute effect concentrations are extremely high compared to chronic effect concentrations (large ACRs), whether the ACR approach should be even used warrants some consideration. Large ACRs are not, *per se*, less accurate than low ACRs, provided acute and chronic effect concentrations are well defined and the issue is simply extrapolating from acute to chronic toxicity within a species. However, for criteria calculations, the FACR needs to be a ratio that extrapolates from the fifth percentile of the acute effect concentration distribution to the fifth percentile of the chronic effect distribution. This requires appropriately combining ACR

information across species, the accuracy of which might be affected by large ACRs even if the accuracy of the individual ACRs is not. Therefore, in addition to not needing a CMC, extreme acute tolerance might also warrant direct calculation of the CCC rather than using the ACR approach, and thus eliminate the need for fulfilling all of the minimum acute toxicity test requirements as specified by the *Guidelines*.

How should data requirements for tolerant taxa be addressed?
The fifth percentile calculation methods for the CMC (as well as the CCC if the eight minimum data requirements noted above are met) require actual GMAV (or GMCV) values only for the four most sensitive genera. For more tolerant genera, it is only necessary to know that these toxicity values are greater than those of the four sensitive species. Therefore, toxicity test results that report "greater than" effect concentrations are acceptable for the tolerant taxa, and in fact are used in various criteria already.

If chronic tests have not already been done on some taxa needed for the minimum data requirements, but which are known to be tolerant, testing resources might be wasted by generating numbers that will not affect results. If methods such as inter-chemical or inter-species extrapolation methods, or assays (e.g., *in vitro* tests, biomarkers) that have been related to apical effects such as reductions in growth, survival, or reproduction can demonstrate these taxa to be insensitive compared to other taxa, actual chronic tests on these taxa may not be needed. In other words, can minimum data requirements for tolerant taxa be satisfied by some type of estimation rather than by an actual test result?

However, adding estimated data can become a rather open-ended process. Therefore, consideration must be given to how many estimated values should be allowed, relative to measured values, to produce an appropriate distribution of taxa in the data set used for criteria derivation.

Should fish chronic tests be required to address reproduction?
For chemicals (e.g., environmental estrogens) for which reproductive toxicity is of most concern, the allowance in the *Guidelines* for using ELS tests might need reconsideration. The *Guidelines* already give priority to life-cycle and partial life-cycle tests when they are available and show greater sensitivity than ELS tests. However, other information (from other species, similar chemicals, knowledge of the MOA) regarding latent or multigenerational reproductive effects may demonstrate the importance of sexual development and reproduction, so as to establish a basis for not considering ELS test results (or even partial life-cycle tests), but rather requiring life-cycle tests for fish.

What endpoints can serve as surrogates for traditional chronic endpoints?
Although chronic criteria are and will continue to be based on effects on reproduction, growth, and survival, another issue is whether only toxicity data directly addressing these endpoints is acceptable. Is there additional information (e.g., sub-organismal biomarkers, behavioral data) that can be used in criteria derivation because they are adequately correlated to reproduction, growth, and survival? Use of such data would be consistent with the *Guidelines* requirements to examine all pertinent data and make modifications to the criteria derivation procedures that are consistent with sound scientific evidence

2.3 Precedent for Deviating from Basic ALC Derivation Procedures

The recent ALC document for tributyltin (TBT) provides a good example of some of the types of procedural criteria modifications discussed above. TBT is a highly toxic biocide that has been used extensively in anti-fouling paint to protect the hulls of large ocean-going ships. It is deemed a problem in the aquatic environment because it is extremely toxic to non-target organisms, and has been linked to imposex (the superimposition of male anatomical characteristics on females) and to immuno-supression in snails and bivalves (U.S. EPA 2003). The concentrations reported to cause imposex in the laboratory are lower (range: 0.0093 to 0.0334 μg/L) than the FCV (0.0658 μg/L) calculated using the standard ALC derivation procedures (U.S. EPA 2003). The low effect concentrations established for female gastropods in the laboratory were subsequently corroborated in field studies. The CCC was lowered (to 0.0074 μg/L) based on the judgment that these effects were relevant for the risks of TBT to gastropod reproduction.

3.0 CHARACTERISTICS OF CECS AND THEIR INFLUENCE ON ALC DEVELOPMENT

As described in Section 1.0, chemicals become labeled as CECs for a variety of reasons, many of which have relatively little to do with their toxicological characteristics. Consequently, the Guidelines cannot be interpreted or modified in one particular way that would be universally appropriate for all CECs. However, some characteristics may be shared by various CECs, such that discussing the implications of these characteristics in the context of deriving water quality criteria is worthwhile. The expected outcome is additional guidance addressing key issues that may arise and how best to accommodate these issues in deriving criteria.

Much of the technical discussion that follows is centered on EDCs and, even more specifically, around chemicals that interact with the hypothalamic/pituitary/gonadal (HPG) axis. Endocrine function controlled via the HPG axis involves hormones broadly known as estrogens ("female" hormones such as estradiol) and androgens ("male" hormones such as testosterone), along with the body tissues and biochemical machinery with which they interact. Effects on this part of the endocrine system of various aquatic species have been documented in the literature, and publicized in the media, making toxicological disruption of this mechanism a good choice for discussing CECs in the context of the *Guidelines*. However, these types of substances are only a subset of EDCs, and an even smaller subset of CECs as a whole. While much of the discussion that follows uses HPG-active chemicals as a point of reference, the concepts presented may be useful in the derivation of ALC for many other chemicals as well. It is the principles more than the specifics that are important in considering the content of this report.

3.1 Characteristics of HPG-Active EDCs

While estrogenic and androgenic hormones are a core component of the HPG axis, this system also includes a much larger group of tissues and biochemical machinery within the body which, in vertebrates, govern sexual development, maturation, and reproduction. Commensurate with this complexity, there are many places within the system that environmental chemicals may act to modify the normal function of the HPG-axis. Thinking simply of "estrogenicity" or "androgenicity" as toxicological modes of action is still too broad – these categorical classes are more the outward "symptoms" of disruption in the HPG axis than they are unique modes of toxicological action. For example, the synthetic steroids EE2 and trenbolone bind to (and act as agonists of) vertebrate estrogen and androgen receptors, respectively, with similar or greater affinity than the natural endogenous hormones, estradiol and testosterone. In contrast, a variety of other medicinal pharmaceuticals are specifically designed to do the opposite, to be antagonists of these same receptors. As examples, tamoxifen (breast cancer treatment) and flutamide (prostate cancer treatment) bind quite specifically to vertebrate estrogen and androgen receptors, respectively, thereby blocking the activity of endogenous steroid hormones. But disruptors of the HPG axis are not limited to chemicals that bind directly to estrogen or androgen receptors; they also include chemicals that interact elsewhere in the overall biochemical pathway. As an example, there are chemicals that exert their activity through interactions with CYP (cytochrome

P450) enzymes involved in steroid production. The pharmaceutical chemical fadrozole acts to inhibit CYP19 aromatase, the enzyme that converts estradiol to testosterone. A number of conazole fungicides act as competitive inhibitors of several CYPs further up the steroid synthesis pathway (Ankley et al. 2005).

Unlike many other chemicals that have either non-specific (e.g., narcotics) or more generalized reactive modes of action (e.g., electrophilic chemicals interacting with nucleic acids and proteins), HPG-active compounds tend to have very specific interactions with particular molecular targets within the biochemical pathway. There are a number of consequences arising from this specificity. One important consequence of target specificity is potency. Many pharmaceuticals are designed to be highly specific, and thus are extremely potent. For example, EE2 and trenbolone affect reproduction and development in fish at water concentrations in the very low ng/L (part-per-trillion) range (e.g., Ankley et al. 2003; Länge et al. 2001), well below effect concentrations for most chemicals for which current ALC have been derived. These very low biologically-active concentrations present substantial challenges for analytical determinations associated either with lab-based effects testing or field monitoring of *in situ* exposures. In the case of EE2 and/or trenbolone, effects observed in fish are at concentration levels below the methodological limit of detection for most laboratories even in laboratory test water, and even more so ambient water and effluents.

Such high potency can influence how one would approach criteria derivation when the chemicals exert minimal acute toxicity, but cause mostly long-term, sub-lethal effects. Trenbolone and EE2 illustrate this situation quite well. Like most pharmaceuticals (some exceptions being chemotherapy and anti-parasitical agents), these chemicals are designed to "adjust" the biochemistry of the body without causing acute toxicity or other significantly adverse side effects. As a consequence, these types of pharmaceuticals tend to have low toxicity in short-term lethality assays (Webb 2001). In the context of criteria development, this has implications for the use of ACRs. Most conventional toxic pollutants with EPA ALC have ACRs of 10 or less (Cunningham et al. 2006; Host et al. 1995). In contrast, ACRs for EE2 and 17β-trenbolone in fish have been shown to range from 1,000 to greater than 300,000 (Ankley et al. 2005). Again, this is a result of relatively low acute toxicity and high chronic potency. Importantly, limited data for other MOA classes of pharmaceuticals suggest that this phenomenon is not restricted to endocrine-active substances. For example, Huggett et al. (2002) reported an ACR in fish of about 50,000 for propanolol, a β-blocker. As discussed in Section 2, this large difference in acute and chronic potency may both make CMC values moot in the environmental management of these chemicals, and introduce uncertainty in the extrapolation between acute and chronic effects in the derivation of a CCC.

The specificity of the molecular target also can greatly affect those taxa likely to be sensitive to the chemical MOA of concern. While some biological pathways (e.g., energy metabolism) tend to be highly conserved across all organisms, others can be quite specific to certain phylogenetic groups. Although the control of reproductive function through the HPG axis is highly conserved across vertebrate classes, lower taxonomic groups such as invertebrates have different endocrine system structure that function differently. For example, Segner et al. (2003) tested several estrogenic chemicals, including EE2, in a variety of partial and full life-cycle tests with a model fish (zebrafish) and several aquatic invertebrate species. They found that the fish was by far most

sensitive to the effects of the estrogenic chemicals, and was the only species that responded to EE2 at environmentally-relevant concentrations. As a result, it is likely that chronic toxicity data for fish would be the most influential in setting the criterion for EE2, and correspondingly unlikely that toxicological data for invertebrate species would have much impact. Plants do not have comparable endocrine system structure or function, and would not be expected to be sensitive to these types of compounds, but there is research that indicates that algal species may be a uniquely sensitive taxa for the assessment of other types of CECs such as antibacterial products like triclosan (Orvos et al. 2002; Wilson et al. 2003).

Specificity in MOA can also affect how or if effects are expressed within a toxicity test, even in potentially sensitive species. In the case of chemicals that affect endocrine function, there are distinct "windows" when animals are likely to be sensitive and/or exhibit adverse outcomes. For example, a popular amphibian early developmental assay-FETAX (Frog Embryo Teratogenesis Assay-*Xenopus*) would be inadequate for detecting thyroid-active toxicants because the period of exposure and observation occurs early in development before the thyroid axis is functional in *Xenopus*. In the case of HPG-active toxicants, there are two windows of sensitivity during an animal's life: during sexual differentiation in developing organisms (when "organizational" alterations occur), and during active reproduction in adults (when "activational" responses can be manifested; Ankley and Johnson 2004). As a result, it is critical that testing for HPG-active EDCs occur during periods when the system is vulnerable to disruption. It is equally critical that toxicity tests include observations during the periods when effects are expressed. Some of the changes caused during sensitive early developmental windows may not be expressed until later in life. For example, the ELS toxicity test protocol commonly used in criteria development to estimate the chronic sensitivity of fish contains the early life stages that could be sensitive to disruption of sexual development, but it does not extend through to maturation, and would therefore be insensitive for detecting disruption of sexual development.

3.2 Implications for ALC Development

As is clear from the text above, some characteristics of HPG-active chemicals (and many other CECs) create the need to carefully interpret the intent of the *Guidelines*, not just the routine derivation process. As indicated in Section 2.0 there is nothing about CECs that invalidates the principles embodied in the *Guidelines*; however, the *Guidelines* were written before many of the issues discussed in Section 3.1 were known, so they do not necessarily contain prescriptive guidance for some of the nuances created by some CECs. The following paragraphs discuss the implications of these issues for criteria development, following the four general topic areas outlined in Section 2.0:

- The need for and relevance of acute toxicity data and a CMC;
- Defining minimum data requirements in terms of taxonomic coverage;
- Defining appropriate chronic toxicity data; and
- Selecting effect endpoints upon which to base criteria

3.2.1 The Need For and Relevance of Acute Toxicity Data and a CMC

As described in Section 2.2, there are two primary uses for acute toxicity data under the *Guidelines*: 1) the derivation of the CMC; and 2) establishment of the CCC when the FAV/FACR method is used. As a practical matter, if the CMC is more than 96-fold higher than the CCC, then it will always be the CCC that is more limiting. This is because in the standard formulation of criteria, the CMC has a one-hour averaging period and the CCC a 96-hour averaging period; thus, if the difference between them is more than 96-fold, it is mathematically impossible to exceed the CMC without also exceeding the CCC. A minor exception to this issue occurs when ALC are implemented in an NPDES permit such that the CMC is applied to whole effluent while the CCC is applied after mixing, and the available in-stream dilution is large. However, these exceptions are rare, and even the 96-fold difference discussed here pales in comparison to the factors of 1,000 to 300,000-fold discussed previously in regard to EE2 and trenbolone. In cases where such extreme differences between acute and chronic toxicity thresholds exist, establishing ALC as having only a CCC seems a reasonable approach.

While it is easy to see why a CMC would not be necessary when you have sufficient acute test data to show that the CMC would be dramatically higher than the CCC, this begs the question of how much data are needed to decide that this is the case. This decision should occur during the "problem formulation" step in the risk assessment for a specific chemical/class, and should be guided by the following types of information:

- the amount and phylogenetic spread of acute toxicity data that are available;
- toxicity data from short-term exposures that do not meet the strict definitions in the *Guidelines* of acute toxicity data acceptable for criteria derivation, but from which information on responses to acute exposures can be inferred;
- short-term effect data garnered from longer-term exposures;
- information from closely related chemicals that are thought to have the same MOA, and have more robust acute data sets; and
- knowledge of the degree of phylogenetic distribution of the toxicity pathway of concern.

A complicating issue resulting from a "moot" CMC is that data availability for acute effects will likely be limited. As such, having less than the required acute MDRs may preclude the ability to derive a CCC using the FAV/FACR approach typically used in the *Guidelines*. For chemicals with highly specific modes of action and large ACRs (such as many EDCs), it is very likely that the mechanisms for acute and chronic toxicity differ, since biological activity resulting in chronic effects is designed into the product and not a secondary consequence - such as many of the historical contaminants for which EPA has developed criteria. Also, sensitivity of different taxa classes to acute and/or chronic toxicity varies widely due to presence (or absence) and structure and function of phylogenetically-conserved systems. Both of these issues would introduce considerable uncertainty into the availability and interpretation of ACRs, and probably make it inadvisable to use the FAV/FACR approach anyway. The *Guidelines* discuss the inadvisability of using the ACR approach when ACRs vary by more than a factor of 10 without a clear relationship to taxonomy or acute sensitivity (page 41 of the *Guidelines*). A more advisable approach would generally be to develop a CCC directly from a sufficiently robust set of chronic data, using the procedures outlined in the *Guidelines* or an appropriate modification thereof.

3.2.2 Defining Minimum Data Requirements in Terms of Taxonomic Coverage

To develop a CCC directly from chronic toxicity data (rather than via FAV/FACR), the *Guidelines* require that acceptable chronic toxicity data be available from at least eight families with a taxonomic distribution fulfilling the requirements specified in the *Guidelines* (referred to as the "minimum data requirements" or "MDRs"). Having a blanket requirement for meeting the eight MDRs was included to insure a minimum level of "certainty" that the *Guidelines* will be protective of the broad phylogenetic distribution of organisms found in aquatic systems. Including this phylogenetic spread also enables criteria to be developed for chemicals for which the toxicological MOA is not known. Instead of "knowing" what organisms are most likely to be sensitive to a particular chemical, requiring a broad spread of empirical toxicity data makes it likely that whatever taxa may be sensitive to a chemical, they will be represented to some degree in the toxicity data set.

In the case of EDCs, PPCPs, and certain other chemical classes, we may have a reasonable understanding of the toxicological MOA for the chemical, and from that knowledge we may be able to infer what taxa are most likely to be sensitive to a particular chemical (Ankley et al. 2007; Williams 2005). As discussed in Section 2.2, the procedure used in the *Guidelines* for estimating the 5th percentile of a toxicity distribution is dependent on only the four lowest values; for this reason exact values for insensitive genera are not necessary, as long as there are sufficient data to infer that their sensitivity is lower than the four most sensitive genera.

So how does one determine that a particular taxon is insensitive? The general structure of the *Guidelines* presumes that sensitivity is determined by conducting an acceptable toxicity test with that taxon. However, one can infer that the actual need is only to have sufficient information to conclude that the taxon is insensitive; if that determination can be confidently made based on other information, the information need may be met even if an actual toxicity test with that particular organism and chemical has not been conducted. This does not change the intent of the *Guidelines*. It only acknowledges the possibility that there is more than one way to meet the information requirement.

Using the example of EE2, there is both physiological understanding and some empirical toxicity data to support the belief that vertebrates will be far more sensitive to EE2 toxicity than will invertebrates (see Part II of this white paper and Segner et al. 2003). As such, it would seem inappropriate to invest resources in testing a wide range of invertebrate taxa classes for sensitivity when all existing data indicate that the data would not affect the final criterion, which would be driven by sensitivity of vertebrates. In this case, it makes sense to argue that certain of the eight MDRs might be declared met not through direct testing, but through toxicological understanding of the chemical's MOA and the physiology of those other taxa or existing toxicity data that establishes sensitivity differences among taxa.

While this logic is clear, one must be careful in presuming that the primary MOA demonstrated by organisms with the target physiology is the only toxic MOA for the chemical. Particularly given the phylogenetic diversity of organisms, it is always possible that a chemical that behaves

with one MOA in one class of organisms may exert toxicity through a different mechanism in a different phylogenetic group. There are precedents for this scenario (Ankley et al. 2007). For example, exposure to the non-steroidal anti-inflammatory drug diclofenac via consumption of dead livestock has greatly diminished some populations of vultures in several East Asian countries. Diclofenac kills the birds through renal failure, which is only a relatively minor side-effect of the drug in mammals. While the mechanism of renal toxicity in vultures is likely molecularly related to the mechanism of therapeutic action in man, i.e., both seem to occur due to inhibition of prostaglandin synthesis (Meteyer et al. 2005), the inhibition of similar molecular components appears to be manifested as dramatically different whole organism endpoints. The key is in achieving a reasonable balance between expending resources on collecting data most likely to influence the criterion, while maintaining some kind of backstop against initially unexpected toxicity in other organisms.

One possibility for enhancing confidence regarding phylogenetic sensitivity is in considering data for other, closely-related chemicals with the same MOA. While the *Guidelines* focus analysis on toxicity data for the specific chemical in question, an understanding of toxicological MOA can also lead to an understanding of how other chemicals might act to exploit the same biological system in the same way. For example, one might reasonably infer that the relative species sensitivity to EE2 is likely similar to 17-ß estradiol (E2), the natural hormone which EE2 mimics. If, for example, there were a taxon which had been tested and found insensitive to E2, but had not been tested with EE2, it seems a reasonable assumption that that taxon would also be insensitive to EE2.

The possibility of fulfilling certain information requirements using data other than from direct toxicity testing does raise some other interpretation challenges, in particular the definition of the sample size for determining the 5th percentile of the genera sensitivity distribution. For example, if one has reason to believe that all crustaceans would be insensitive to a chemical, how many genera does that assertion represent in the calculation of the genera sensitivity distribution? While this is a real issue that will have to be addressed, we believe the problem is tractable and the details of the resolution are left to later work.

Because of the risk that our mechanistic understanding of a chemical may be incomplete, it seems unlikely that one could justify completely bypassing several MDRs solely on theoretical arguments (e.g., developing a criterion for a testosterone mimic based only on chronic toxicity data for vertebrates, with no invertebrate data at all). At the same time, prudent application of other data types to fulfill certain information requirements for criteria derivation does seem appropriate. Given the tremendous variation in understanding and availability of data likely to exist for different CECs, it is presumed that at least initial application of this approach will have to be justified on a chemical-by-chemical basis using appropriate scientific judgment. However, lines of evidence that might be applicable to this determination include:

- an in-depth understanding of the toxicological (or, in the case of drugs, therapeutic) MOA;
- information on the basic physiology of other taxa in relation to the MOA;
- toxicity data from chronic exposures or other relevant experiments that do not meet the strict definitions of acceptable chronic data given in the *Guidelines*, but from which

information on relative taxon sensitivity can be inferred; and

- information from closely related chemicals that are thought to have the same MOA and have more robust acute or chronic data sets.

A separate, but related issue arises in respect to data from species not resident to North America. The *Guidelines* specify the use of toxicity data only from species resident to North America. However, particularly in regard to the study of EDCs, some fish species not resident to the U.S. have been advanced as experimental models for the evaluation of the chronic effects of EDCs to fish. Two clear examples at the time of this report are the zebrafish (*Brachydanio rerio*) and the Japanese medaka (*Oryzias latipes*), for which equivalency of EDC test data (with the fathead minnow) has been proposed through international groups such as the Organization for Economic Cooperation and Development (OECD; Ankley and Johnson 2004). These species have a rich toxicological database, and we know of no reason to believe that their sensitivities would be expected to be substantively different from sensitivities of at least some fish resident to the U.S. In keeping with international harmonization, we suggest that toxicity data from species with recognized international equivalency be included in criteria derivation with the full weight given to data from resident species.

3.2.3 Defining Appropriate Chronic Toxicity Data

The *Guidelines* state that acceptable chronic tests for criteria derivation are full life-cycle exposures (F_0 egg to F_1 offspring) for both vertebrates and invertebrates, as well as partial life-cycle (adult to juvenile) and early life-stage (ELS; egg to juvenile) tests for fish. The acceptance of ELS tests in particular as acceptable chronic tests is predicated on the work of McKim et al. (1978) and other evidence that the toxicity thresholds obtained from ELS tests are generally within a factor of two of the thresholds from life-cycle chronic tests.

While this general approach has been applied with apparent success for many chemicals, the *Guidelines* intimate concerns with the approach, noting that for some chemicals, ELS tests might not be good predictors of chronic toxicity, which would violate the principle underlying the use of ELS tests as chronic data (page 39 in the *Guidelines*). As noted previously, toxicological data for chemicals like EE2 show that certain chemicals may have potent effects on life processes that lie outside the exposure period represented by ELS tests (e.g., pronounced effects on reproduction), or on life processes for which the expression of effects does not occur until after the ELS period (e.g., embryo or larval exposure resulting in effects on sexual development and maturation in adult fish; see Section 3.1). It is clear from these examples that there are chemicals for which ELS tests should not be used as surrogates for full life-cycle exposures. In fact, chemicals that affect sexual differentiation may not be adequately assessed even with partial life-cycle exposures, since these protocols do not generally include observation of sexual development/maturation in fish exposed during early development.

While the "Good Science" clause and other text in the *Guidelines* would not support reliance on ELS tests as chronic data for chemicals known to have specific effects on other life processes, such as sexual development or reproduction, the *Guidelines* would allow the development of a criterion using only ELS data for fish if there were not any specific data to indicate that this approach would be inappropriate. This is akin to an "innocent until proven guilty" approach.

However, we believe experiences with chemicals like EDCs make clear the need to move from the previous approach to one of "guilty until proven innocent." In other words, it is probably wiser to require that the chronic toxicity data for fish include exposure and observation over a full life-cycle unless there is an affirmative reason to believe that it is not necessary (note: this issue is equally relevant to invertebrates species, but the ELS tests discussed in the *Guidelines* are focused explicitly on fish; invertebrate tests would already be required to be life-cycle). In keeping with this shift in emphasis, we believe the requirements for chronic toxicity data in the *Guidelines* should be tightened by adding the further requirements that either:

1) Full life-cycle data be available for at least one fish species; or

2) There is a body of experimental information indicating that life processes outside the ELS or partial life-cycle exposure/observation windows would not be important to capturing the important toxicological effects of the chemical.

At first glance, #2 may seem like requiring the proof of a negative, in that one would have to actually conduct the life-cycle test required by #1 in order to show that #2 is true. However, we believe there may be circumstances in which there may be data that speak to the sensitivity of different life stages that come from studies that, while scientifically valid, for some reason do not meet all the requirements of a valid life-cycle test as defined in the *Guidelines*. For example, there may be data for a life-cycle test with a non-resident species that includes the relevant life processes but does not qualify as an acceptable chronic test for the derivation of criteria because it is non-resident. Alternatively, there may be data from experiments that violate other requirements of acceptable toxicity data under the *Guidelines*, but still provide insight into sensitive exposure periods or life processes. Even though CVs from such data may not be used directly to calculate a chronic criterion, it seems reasonable to use such data to evaluate the question of where in the life-cycle there are important windows of exposure and/or effect and how that constrains the adequacy of ELS tests to represent chronic toxicity. In other cases, there may be sufficient information from other types of research to demonstrate to a reasonable level of certainty that a chemical's toxicological mechanism(s) would not preclude the use of ELS tests as indicators of chronic toxicity.

Where life-cycle toxicity data are available, the results of those experiments should be carefully examined to determine the likelihood that important windows of exposure or effect lie outside ELS test protocols. Obviously, if there is meaningful potential for effects outside the ELS exposure period, ELS tests should not be used as surrogates for more involved chronic tests. It may also be that the knowledge of toxicological mechanism for a particular chemical may be sufficient that meaningful chronic toxicity data could be developed from exposures that have a structure different from the life-cycle, partial life-cycle, and ELS protocols defined explicitly in the *Guidelines*. While defining such alternate protocols is beyond the scope of this document, we recognize the potential for such a situation and leave it to appropriate implementation of the "Good Science" clause to allow for inclusion of such alternative exposure protocols as surrogates for chronic toxicity data, most likely in addition to, rather than instead of, data from life-cycle toxicity tests.

At the other end of the spectrum lie toxicity tests that extend beyond the definition of a full life-

cycle test, often referred to as multi-generational tests. Because they encompass the full range of life processes as a life-cycle test, we feel that they should be included as acceptable chronic tests, assuming they meet all other requirements for test acceptability. Some studies have reported effects from EDC or other chemicals in which exposure to one generation creates effects in a later generation that were not observed in prior generations even at the same life stage (Nash et al. 2004). If substantial, such effects could create a situation where even full life-cycle toxicity tests might underestimate the chronic toxicity of a chemical and therefore produce criteria that are potentially under-protective. While we recognize the potential for this situation, at present we believe there is not sufficient reason to make multi-generational testing a requirement for criteria development, unless there is specific, compelling information that a criterion would be substantially under-protective if multi-generational effects were not rigorously considered.

3.2.4 Selecting Effect Endpoints Upon Which to Base ALC

The selection of endpoints appropriate to the derivation of ALC must be tied to the narrative intent of the overall *Guidelines*. The stated goal of ALC is to "protect aquatic organisms and their uses" (see *Water Quality Standards Handbook*; U.S. EPA 1994b). While the exact meaning of "protection" is not defined, there is considerable discussion in the *Guidelines* document that makes clear that protection does not mean the prevention of any measurable biological effect in any organism. Instead, there is discussion of endpoints that are "biologically important" and prevention of "unacceptable effects"; this implies that in the context of criteria there are effects that are "biologically unimportant" and/or levels of effect that are "acceptable." Related concepts include the idea that natural populations can withstand some magnitude/frequency of disturbance and still meet the intent of the *Guidelines*.

With "protection of aquatic organisms and their uses" as the assessment endpoint, a decision must be reached as to which biological responses (measurement endpoints in risk assessment parlance) are appropriate to address this goal. Survival, growth, and reproduction are processes that are generally accepted as being directly related to this goal, as these are all demographic parameters that directly affect population dynamics (although, the exact quantitative relationship is not always fully determined). However, there are many more biological responses that have been observed in response to toxicant exposure, both at the whole organism level (e.g., behavior) and at lower levels of biological organization (e.g., biochemical or histological changes). For many of these endpoints, their relationship to the assessment goal, "protection of aquatic organisms and their uses," is less clear. In this regard, we must consider an additional goal of the *Guidelines* – that criteria "provide a reasonable and adequate amount of protection, with only a small possibility of considerable overprotection or under-protection" (page 5 of the *Guidelines*). In keeping with this intent, it is important that criteria focus on endpoints that affect the assessment endpoint, but not create overprotection by preventing any measurable effect (or possibility of that effect). There must be a reasonable, affirmative connection between the measured response and the assessment endpoint.

The Agency's *Framework for Ecological Risk Assessment* (U.S. EPA 1992) identifies this problem:

In many cases, measurement endpoints at lower levels of biological organization may be more sensitive than those at higher levels. However, because of compensatory mechanisms and other factors, a change in a measurement endpoint at a lower organizational level (e.g., a biochemical alteration) may not necessarily be reflected in changes at a higher level (e.g., population effects). (p. 14)

And later on:

Ideally, the stressor-response evaluation quantifies the relationship between the stressor and the assessment endpoint. When the assessment endpoint can be measured, this analysis is straightforward. When it cannot be measured, the relationship between the stressor and measurement endpoint is established first then additional extrapolations, analyses, and assumptions are used to predict or infer changes in the assessment endpoint. (p. 23)

Measurement endpoints are related to assessment endpoints using the logical structure presented in the conceptual model. In some cases, quantitative methods and models are available, but often the relationship can be described only qualitatively. Because of the lack of standard methods for many of these analyses, professional judgment is an essential component of the evaluation. It is important to clearly explain the rationale for any analyses and assumptions. (p. 23)

Existing criteria documents contain many types of data that were not used in the criteria derivation (the documents collate and review these data, but they are not used to actually define the criterion concentration) and it is useful to the discussion here to consider how such data have been interpreted. For example, the following text is derived from the most recent criteria document for ammonia (U.S. EPA 1999, see Appendix 5):

Endpoint indices of abnormalities such as reduced growth, impaired reproduction, reduced survival, and gross anatomical deformities are clinical expressions of altered structure and function that originate at the cellular level. Any lesion observed in the test organism is cause for concern and such lesions often provide useful insight into the potential adverse clinical and subclinical effects of such toxicants as ammonia. For purposes of protecting human health or welfare these subclinical manifestations often serve useful in establishing 'safe' exposure conditions for certain sensitive individuals within a population.

With fish and other aquatic organisms the significance of the adverse effect can be used in the derivation of criteria only after demonstration of adverse effects at the population level, such as reduced survival, growth, or reproduction. Many of the data indicate that the concentrations of ammonia that have adverse effects on cells and tissues do not correspondingly cause adverse effects on survival, growth, or reproduction. No data are available that quantitatively and systematically link the effects that ammonia is reported to have on fish tissues with effects at the population level. This is not to say that the investigators who

reported both tissue effects and population effects within the same research did not correlate the observed tissue lesions and cellular changes with effects on survival, growth, or reproduction, and ammonia concentrations. Many did, but they did not attempt to relate their observations to ammonia concentrations that would be safe for populations of fish under field conditions nor did they attempt to quantify (e.g., increase in respiratory diffusion distance associated with gill hyperplasia) the tissue damage and cellular changes (Lloyd 1980; Malins 1982). Additionally, for the purpose of deriving ambient water quality criteria, ammonia-induced lesions and cellular changes must be quantified and positively correlated with increasing exposures to ammonia.

In summary, the following have been reported:

1. Fish recover from some histopathological effects when placed in water that does not contain added ammonia.

2. Some histopathological effects are temporary during continuous exposure of fish to ammonia.

3. Some histopathological effects have occurred at concentrations of ammonia that did not adversely affect survival, growth, or reproduction during the same exposures.

Because of the lack of a clear connection between histopathological effects and effects on populations, histopathological endpoints are not used in the derivation of the new criterion, but the possibility of a connection should be the subject of further research.

As discussed in greater detail below, chemicals such as EDCs have been shown to produce a wide variety of measurable changes at many different levels of biological organization. The challenge is to select from among those the endpoints that have sufficiently clear connection to expected effects on populations of aquatic organisms.

3.2.4.1 Specific Examples of Measurable Changes at Different Levels of Biological Organization

The range of organismal endpoints that have been reported in the literature is vast, and varies to some degree on the organism and toxicant. With respect to only the HPG axis in vertebrates, this range of endpoints over and above direct measures of survival, growth, and reproduction includes:

- Biochemical measures (e.g., the female-specific yolk precursor protein vitellogenin; native hormones estradiol, testosterone, 11-ketotestosterone);
- Histopathological measures (e.g., proportion of spermatogonia, presence of testis-ova, oocyte atresia, Leydig cell hyperplasia/hypertrophy);

- Gross morphology (e.g., secondary sex characteristics: nuptial tubercles, coloration, ovipositors); and
- Behavioral measures (e.g., nest building, defense/aggression).

A comprehensive survey and evaluation of all such endpoints is far beyond the scope of this document. In lieu of that, this section presents in depth discussion of several individual measures relevant to the HPG axis, including their strengths and weaknesses as direct indicators of likely population level effects. The point of this discussion is simply to provide examples of the issues that must be considered in making a decision as to the biological importance and scientific defensibility for a specific endpoint, organism, or toxicant as it pertains to ALC derivation. These decisions will likely require case by case consideration; in certain circumstances, the suitability of a particular endpoint may vary across chemicals depending on how an individual chemical influences that endpoint.

One of the challenges that arises when incorporating alternative endpoints into criteria derivation is the need to not only conclude that the endpoint warrants consideration, but also establish some definition of what level of effect on that endpoint is unacceptable. While these links may not be completely quantitative, one would not want the definition of an unacceptable effect on one endpoint to be grossly disproportional to that considered unacceptable for another (i.e., if a 20% reduction in reproduction is considered unacceptable, what degree of estradiol (E2) suppression is equivalent to a 20% reduction in reproduction?).

In the text that follows, endpoints are categorized as being either "organizational" or "activational." Organizational endpoints are those that are a result of changes to the normal growth and development of an organism, and are generally not reversible with cessation of exposure. Activational endpoints are those that occur in comparatively plastic tissues in response to exposure, but which may revert to their prior or normal condition with cessation of exposure.

Organizational Endpoint: Sex Reversal

Exposure of developing fish to endocrine-active materials during sensitive "windows" in early development can skew phenotypic sex dramatically toward either females (estrogenic chemicals) or males (androgenic chemicals). This response has been exploited by aquaculturists, who for many years have used potent natural or synthetic steroids to produce mono-sex stocks. The sensitivity of fish to this type of "sex reversal" is species-specific, and critical windows of exposure can vary markedly across species. The response can be manifested in several different ways, ranging from more or less completely sex-reversed animals (i.e., occurrence of gonads and secondary sex characteristics completely reflective of the opposite sex) to more subtle changes, such as the occurrence of intersex gonads (discussed further below). A significant challenge in assessing this condition-either in the lab or field-is knowledge of actual genetic sex of the fish. Since the molecular basis of sex determination in many fish is not known, reliable genetic markers of what sex an animal is programmed to be are not available for most test species (one notable exception here is the Japanese medaka, which is commonly used for endocrine testing in some parts of the world; Ankley and Johnson 2004). The net result of this is that the only way to practically monitor sex reversal in most fish species is indirectly, through analysis of sex ratios (generally based on phenotypic sex). This requires, of course, considerable background

knowledge concerning "normal" sex ratios for a species (or even strain) of fish. For some lab test species (e.g., fathead minnow), the normal sex ratio appears to be about 1:1, while for other commonly-tested small fish models (e.g., zebrafish), the ratio can be quite variable (Ankley and Johnson 2004). In field studies, collection of accurate sex ratio data also can be exceedingly difficult, depending on variables such as sampling gear and location and timing of collections.

Changes in the sex ratio of populations of fish, either in the lab or field, can be quite indicative of an endocrine-specific MOA, indicating exposure to estrogenic or androgenic chemicals (or even chemicals that block the actions of sex steroids). Significantly, from a risk assessment perspective, alterations in sex ratio could also have direct implications for spawning success and population viability. The degree to which sex ratios are critical in determining embryo production will vary based on reproductive strategies of the species of concern (e.g., broadcast versus paired spawners); however, from an evolutionary perspective, one would speculate that any departure from normal sex ratios for a species/population might be considered maladaptive.

Organizational Endpoint: Intersex

Exposure to certain classes of endocrine-active chemicals during critical windows in early development can produce intersex gonads (commonly termed testis-ova), a situation in which the gonads simultaneously contain both ovarian and testicular tissue. Different studies from around the world have shown an elevated occurrence of intersex fish downstream of municipal effluents containing natural and synthetic steroidal estrogens, including EE2 (WHO 2002). In fact, collection of intersex fish from the field has been one of the most visible manifestations of the effects of EDCs on fish/wildlife. For example, in a widely publicized USGS study, Blazer et al. (2007) recently reported that in the South Branch of the Potomac River and select nearby drainages, more than 80 percent of all the male smallmouth bass sampled had oocytes growing within their testicular tissue. Although histology is required to determine and quantify intersex, the techniques involved are relatively straight-forward. What is more challenging than measurement is interpretation of the results. For example, it appears that some degree of background intersex can occur, even in species held under carefully-controlled conditions (Grim et al. 2007). The degree of background intersex and sensitivity to chemically-induced intersex appear to be quite species-specific, requiring a thorough understanding of normal gonad differentiation and development in the species of concern.

Even in species for which background intersex is low, there is uncertainty as to the degree to which the condition could occur and not interfere with normal reproductive function. For example, in a field study in the UK, Jobling et al. (1998) noted a wide range of intersex in roach collected, even from the same site, with severity of the response ranging from occurrence of a few primary oocytes in otherwise normal testicular tissue to instances where there was a complete absence of sperm ducts in the males. Arguably, the former fish could produce viable sperm, while the latter certainly would not. So, although intersex is an intuitively reasonable endpoint upon which to base predictions of possible adverse effects of endocrine-active chemicals on reproductive success, determination of the relationship between severity of the condition and production of viable embryos is required to conduct this analysis.

Activational Endpoint: Behavior

Although not usually considered a biomarker in the traditional sense, behavior is an endpoint that historically has been seldom used for ecological risk assessment, including the derivation of ALC. There are several reasons for this: (1) the types of assays used to assess behavior can be quite labor-intensive, (2) many methods for assessing toxicant-induced behavior have some degree of subjectivity, (3) many behavioral changes (e.g., gill ventilation in fish) are relatively non-specific in that they do not necessarily reflect exposure to chemicals with a specific MOA, and (4) translation of behavioral changes into adverse effects on endpoints such as survival, growth and reproduction can be difficult. Nonetheless, virtually all environmental toxicologists recognize the potential for chemically-induced alterations in behavior to influence the health of individual animals and populations.

There are some compelling reasons to consider behavior as a potentially useful/important endpoint in assessing the ecological risk of certain classes of endocrine-active chemicals. First, estrogens and androgens are known to play relatively specific roles in a variety of reproductive behaviors in fish, including competition for mates, courtship and nest-holding/guarding. Alterations in any of these behaviors theoretically could affect reproductive success and, hence, population status. In recognition of this there have been several recent papers describing straight-forward, relatively quantitative assays for assessing the effects of endocrine-active substances on fish reproductive behavior. For example, Martinovic et al. (2007) conducted a study in which they showed that male fathead minnows exposed to a relatively low concentration of 17β-estradiol, and subsequently placed in a competitive spawning situation with non-exposed males, failed to compete successfully for nesting sites/females. Similar types of results have been reported for other fish species exposed to steroidal estrogens (e.g., EE2; see Part II of this white paper), suggesting that behavioral alterations could be important to consider, especially if they occur at exposure concentrations below those that cause effects on more traditional endpoints such as development and egg production.

Activational Endpoint: Secondary Sex Characteristics

As described above, exposure of developing animals to endocrine-active chemicals can alter phenotypic sex, resulting in skewed sex ratios in populations. These organizational changes observed in secondary sex characteristics (in sexually dimorphic species) and/or gonads typically are not reversible. However, it also is possible to alter secondary sex characteristics, usually in a reversible manner, in sexually-mature fish through exposure to endocrine-active substances. For example, estrogens or anti-androgens can reduce expression of androgen-dependent secondary sex characteristics in males. Similarly, androgenic chemicals can cause female fish to develop male secondary sex characteristics, such as nuptial tubercles in the fathead minnow or elongated anal fins in the Japanese medaka (Seki et al. 2006). Alterations in secondary sex characteristics are much less useful indicators of endocrine-mediated responses in test species, such as zebrafish, with limited sexual dimorphism (Seki et al. 2006).

Alterations in secondary sex characteristics in adult fish can, in some instances, be subtle and somewhat subjective with respect to interpretation. For example, reductions in the status of

existing structures in fish (such as nuptial tubercles in male fathead minnows or anal fin length in male medaka) can be difficult to quantify. However, when there is a *de novo* synthesis of structural characteristics where none previously existed (such as tubercles in female fathead minnows), the response is not only quite specific (in this case to an androgenic MOA), but very easy to detect (i.e., the baseline, control condition is zero).

Although changes in secondary sex characteristics appear to be reasonable mechanistic biomarkers for some endocrine MOA, their utility as a predictor of adverse outcomes (e.g., egg production) is uncertain. Specifically, given our current understanding of fish reproductive physiology/endocrinology, causative links between secondary sex characteristics and gamete quality would be difficult to define. At best, a correlative association may be identified between the two parameters. For example, in studies with the synthetic androgenic steroid 17β-trenbolone, egg production appeared to be reduced at about the same test concentration that caused some degree of nuptial tubercle formation in females (Ankley et al. 2003).

Activational Endpoint: Vitellogenin

Vitellogenin status is probably the most commonly measured endpoint in studies with endocrine-active chemicals in fish. Measurement of the lipoprotein (or its mRNA) is relatively easy via a variety of methods (although most techniques have some degree of species specificity; Wheeler et al. 2005). Production of mRNA (*vtg*) and protein (VTG) in the liver of female oviparous (egg-laying) vertebrates is normally stimulated by activation of the estrogen receptor by endogenous estradiol. The protein is released to the plasma and subsequently deposited in the ovary where it forms a key constituent of developing oocytes. VTG levels in male oviparous animals typically are non-detectable due largely to very low circulating estradiol concentrations; however, males retain the molecular "machinery" in the liver necessary to produce VTG. Hence, exposure to even relatively low amounts of exogenous estrogen or estrogen mimics can stimulate a marked induction of VTG in males. The response not only is specific and sensitive (in part due to a baseline of essentially zero), but relatively sustained after exposure, as the males have no mechanism whereby to clear the protein from their blood.

Although *vtg* and/or VTG induction in male fish is an excellent biomarker of exposure to estrogens (Lattier et al. 2002), the response appears to have little direct (i.e., causative) value in terms of predicting adverse effects on reproduction (e.g., Wheeler et al. 2005). This perhaps should not be surprising given that VTG production in males is not part of any normal physiological pathway. It is possible, however, that correlative relationships between *vtg* and VTG induction in males by exogenous estrogens (such as EE2) and overall effects on fish population status could be derived (e.g., Kidd et al. 2007). This certainly merits additional study, but at present, it appears that the most technically-defensible use of VTG occurrence in male fish is as an indicator of exposure to estrogenic substances in the field and/or confirmation of chemical MOA in laboratory studies.

As opposed to males, VTG has a clear physiological role in females in that the protein is essential to egg production. Concentrations of VTG in females can be reduced by endocrine-active chemicals that directly or indirectly inhibit steroid (ultimately estradiol) production. For example, aromatase inhibitors such as some conazole fungicides decrease steroid production by

inhibiting enzymes involved in steroidogenesis, while other androgenic chemicals like trenbolone decrease steroid production through feedback inhibition in the HPG axis. As a consequence, these classes of endocrine-active chemicals reduce normal VTG production in female fish, thereby reducing fecundity and, ultimately, affecting population status (Miller et al. 2007). Therefore, in the case of females, VTG status may be effectively used as a biomarker both of exposure and effects. Kidd et al. (2007) found that VTG was elevated in female fathead minnows outside of their spawning season. Therefore, elevated VTG in females outside of the spawning season may also be an important measure of stress.

3.3 Pathways and Receptors Beyond the HPG-Axis

As was explained at the outset, this section (Section 3) has a substantial focus on the HPG-axis not because it is the only MOA that is of concern in this document, but because it is currently prominent in both social and scientific arenas. However, it is important to re-emphasize that the use of HPG-active chemicals as a basis for discussion does not imply that this is the only group of CECs of concern with respect to the development of ALC, or the only group for which there may be need for supplementation of the explicit procedures outlined in the *Guidelines*.

As an example, the hypothalamic-pituitary-thyroid (HPT) axis is another endocrine system present in vertebrates that governs important biological pathways and is potentially subject to disruption. Similar to the role of steroid hormones in the HPG axis, actions of the HPT axis are mediated through thyroid hormone, which is involved in the regulation of metabolic activity, energy consumption and muscular activity in adult animals, and the regulation of postembryonic or perinatal growth and development in developing animals, especially in the central nervous system (Chatterjee and Tata 1992). Thyroid hormone is also responsible for the obligatory induction and maintenance of metamorphosis in amphibian and other poikilotherms, and may also play a role in male reproduction (Peterson et al. 1997). Since the actions of thyroid hormone are mediated via binding to highly-conserved nuclear thyroid hormone receptors and modulating transcription of specific genes, disruption of the HPT axis can be disrupted in many ways parallel to those discussed for the HPG axis (Farwell and Braverman 2006), and in doing so, create similar challenges for the development of ALC. Only a few of the developmental actions of thyroid hormones, however, are the result of the direct interaction of the hormone and receptor. Instead, most are indirect via the influence of thyroid hormone on other hormone or growth factors. For example, some of the growth-promoting effects of thyroid hormones on juveniles are indirectly mediated via growth hormone released from the pituitary gland (Chatterjee and Tata 1992).

The amphibian metamorphosis assay is one of the thyroid-relevant *in vivo* screening assays EPA has developed to detect chemicals that interfere with the thyroid hormone system. The assay represents a generalized vertebrate model to the extent that it is based on the conserved structure and functions of the thyroid systems, and thus mirrors some of the assays developed and discussed earlier for the HPG axis. This particular assay is important because amphibian metamorphosis provides a well-studied, thyroid-dependent process which responds to substances active within the HPT axis (Fort et al. 2007). The utility of this and other similar HPT-specific assays for development of ALC is predicated on the principle that the dramatic morphological

changes that occur during post-embryonic development of vertebrates are dependent on the normal function of the HPT axis, and that interference with this process leads to quantifiable effects (Zoeller and Tan 2007).

Other pathways relevant to this discussion could include any of a number of those regulated by different nuclear hormone-type transcription factors, such as the progesterone, glucocorticoid and aryl hydrocarbon (Ah) receptors. Of these the Ah receptor is of particular interest because it has been well studied and is key to the toxicity of several important environmental contaminants such as dioxins and PCBs. Ah receptor agonists are extremely toxic to early life stages of some vertebrates species (e.g., adult fish are at least 10 times less sensitive than early life stages), can induce delayed mortality not captured in short-term (e.g., 96-hour) toxicity tests, and are not very toxic to invertebrates, which lack the receptor (Cook et al. 1993; Mount et al. 2003; Tanguay et al. 2005). Hence, as is true for HPG-active chemicals, knowledge that a contaminant may be an Ah receptor agonist can help focus testing to determine ecological risk (Cook et al. 1993).

Although the previous systems are generally found in vertebrates but not invertebrates, parallel developmental, reproductive, and homeostatic systems exist in invertebrates (Lintelmann et al. 2003) and are most likely just as susceptible to disruption by xenobiotic chemicals. In fact, many pesticides are designed explicitly to disrupt biochemical pathways specific to invertebrates or sub-groups of invertebrates as a means to reduce effects on non-target (vertebrate) organisms. Some endocrine-mediated processes unique to certain taxa of invertebrates include molting, limb generation, diapause, pheromone production, pigmentation and coloration, and metamorphosis. For these processes, the most important endocrine regulators in arthropods are ecdysone and related compounds (ecdysteroids), which are involved in embryonic development, molting, metomorphosis, reproduction, and pigmentation (Lintelmann et al. 2003). Juvenile hormones in insects and methylfarnesoate in crustaceans (both belonging to the class of sexual hormones called terpenoids) are also deemed necessary to mediate the regulatory functions of ecdysteroids (DeFur et al. 1999). Research on the effects of CECs on these systems is still in its early stages, but the parallels with other systems that are susceptible to disruption are clear, and may therefore create similar issues for the development of ALC.

4.0 SUMMARY AND RECOMMENDATIONS

Through its deliberations, the workgroup concluded that the basic framework and conceptual underpinnings of the *Guidelines* apply to CECs as well as other chemicals. Further, the "Good Science" clause of the *Guidelines* provides the flexibility to adopt procedures that will produce a technically rigorous and protective criterion. The focus of this report has been the interpretation and adaptation of the principles set forth in the *Guidelines* with respect to common toxicological characteristics of CECs. In that regard, the workgroup identified a number of possible modifications or alternate interpretations that might aid those developing criteria for CECs to do so in a resource efficient manner that takes best advantage of existing knowledge.

Although some of the recommendations involve increasing flexibility in meeting certain data requirements, the intent is to guide the generation of ALC for CECs that have the same technical rigor as 304(a) criteria developed for other chemicals; these are not methods for "short-cut" criteria. This is a significant point, because an important feature of the *Guidelines* is defining a minimum technical rigor that criteria must have; if insufficient information exists to achieve a minimum level of confidence in the calculated criterion, then criteria should not be derived. The important consequence of this for risk assessors and managers is that when criteria are used to make regulatory decisions, one can have confidence that uncertainty regarding the criterion is not excessive. In other words, criteria derived using the *Guidelines* are often used as both "walk away values" (i.e., there is high confidence that there is little or no risk when exposures are below criteria) and as indicators of risk (implying that effects are likely when criteria are exceeded). If greater uncertainty were allowed in criteria, then the ability to use the values in this way would be compromised.

A negative aspect to establishing a minimum level of information for criteria is that there may be chemicals for which regulatory guidance is needed, but for which toxicological data are insufficient to meet the minimum standards of the *Guidelines*. In such cases, there may still be a need for alternate approaches to derive interim regulatory guidance values on which to base decisions that must be made before sufficient information for a complete water quality criterion can be gathered. While much of the discussion in this report might be useful to inform the development of such an approach, it must be emphasized that developing procedures to derive interim regulatory guidance values based on limited toxicity information is a separate matter and would require considerable additional analysis.

The subsequent sections summarize the issues and recommendations of the workgroup according to the areas of concern identified above.

4.1 Relevance of Acute Toxicity Effect Levels in Setting ALC for CECs

Some CECs may not be acutely toxic, or may only be acutely toxic at environmentally irrelevant concentrations. Thus, if the minimum data requirements for acute toxicity data are not already met by existing data, conducting additional acute tests might be unwarranted. Indication of lack

of acute toxicity in key aquatic species might also warrant direct calculation of the CCC rather than using the FAV/FACR approach, and thus eliminate the need for the full suite of acute toxicity tests normally required.

For a CEC of interest, available information should be reviewed to determine if the CMC would be sufficiently higher than the CCC such that developing the CMC is not needed. Exactly how much data is a risk management judgment, and probably does not have a unique answer. We recommend that the following information be considered when addressing this issue:

- the amount and phylogenetic spread of acute toxicity data available;
- toxicity data from short-term exposures that may not meet the strict definitions in the *Guidelines* of acute toxicity data acceptable for criteria derivation, but from which information on responses to acute exposures can be inferred;
- data on short-term exposures garnered from longer-term exposures;
- information from closely related chemicals thought to have the same MOA that have more robust acute data sets; and
- knowledge of the degree of phylogenetic distribution of the toxicity pathway of concern.

4.2 Defining Minimum Data Requirements in Terms of Taxonomic Coverage

One consequence of dropping acute testing requirements in criteria derivation is the inability to calculate a CCC using the ACR approach, i.e., as the quotient of the FAV and FACR. In addition, for chemicals with large ACRs, it is likely that the mechanisms for acute and chronic toxicity differ (Welshons et al. 2003) and that the sensitivity of different taxa to acute and/or chronic toxicity varies widely. Both of these issues introduce uncertainty into the interpretation of ACRs, and probably make it inadvisable to use the FAV/FACR approach. Under such a circumstance, a prudent approach would generally be to develop a CCC directly from a sufficiently robust set of chronic data, using the procedures outlined in the *Guidelines*. If there is insufficient data from actual toxicity tests to fulfill the MDRs to develop a CCC directly from chronic toxicity data, a reasonable understanding of the toxicological MOA for the chemical may allow inferences as to what taxa (and endpoints) are most likely to be insensitive, such that measured chronic values for those taxa might not be needed. One important consideration in this process is to avoid an excessive number of taxa estimated to be insensitive, relative to those for which actual test results are available, and thus to distort the phylogenetic distribution from that implicit in the MDRs and typical of ALC.

Accordingly, the workgroup recommends that, for chemicals without complete chronic toxicity data sets fulfilling all MDRs, there be an evaluation of whether sufficient information exists to conclude that certain taxa would not be sensitive to the chemical. Given the variation in understanding and availability of data likely to exist for different CECs, it is presumed that at least initial application of this approach would have to be justified on a chemical-by-chemical basis using appropriate scientific judgment. However, lines of evidence that might be applicable to this determination include:

- an in depth understanding of the toxicological (or, in the case of drugs, therapeutic)

MOA;

- information on the basic physiology of other taxa in relation to the MOA;
- toxicity data from chronic exposures or other relevant experiments that do not meet the strict definitions of acceptable chronic data given in the *Guidelines*, but from which information on relative taxon sensitivity can be inferred; and
- information from closely related chemicals thought to have the same MOA that have more robust acute or chronic data sets.

4.3 Use of Non-Resident Species in ALC Development

Historically, EPA has not used data derived from toxicity testing with non-resident species in the actual criteria derivation process. Excluding species simply because they are not resident may be unnecessarily restrictive for the purposes of deriving national criteria, and may actually increase rather than decrease uncertainty. Because ALC are intended to protect "most of the species, most of the time" and use distributions of test data for point estimation, increasing the species representation in the toxicological database should allow better estimation of species sensitivity distributions.

The workgroup recommends that some non-resident species be considered for use in criteria derivation calculations, focusing on those species with widely used and standardized test methods and for which there is no reason to believe would misrepresent the sensitivity of comparable resident species. Furthermore, we specifically suggest accepting data for zebrafish (*Danio rerio*) and Japanese medaka (*Oryzias latipes*), to reflect international efforts toward data equivalency (Ankley and Johnson 2004). This recommendation pertains to the direct use of chronic toxicity data in the calculation of a CCC as is currently done for resident species. It is worth noting that even non-resident species that are not included in criteria calculations may still provide important information on MOA, sensitivity of endpoints, etc., as expanded on further below.

4.4 Defining Appropriate Chronic Toxicity Data

The *Guidelines* state that acceptable chronic tests for criteria derivation are full life-cycle exposures (egg/birth to egg/birth) for both vertebrates and invertebrates, as well as partial life-cycle (adult to juvenile) and early life-stage (ELS; egg to juvenile) tests for fish. For chemicals for which sexual development/maturation or reproductive effects are of most concern, the allowance in the *Guidelines* for using ELS or partial life-cycle fish tests might need reconsideration. The *Guidelines* already give priority to life-cycle tests when they are available and show greater sensitivity than other tests. However, other information indicating the importance of sexual development and reproduction (from other species, similar chemicals, knowledge of the MOA) might also establish a basis for not considering ELS data and for requiring life-cycle or partial life-cycle tests for fish.

At present, a CCC could be derived for a chemical for which chronic toxicity data for fish are limited to ELS exposures. Because of the importance of sexual maturation and reproduction for

determining the chronic toxicity of chemicals like EDCs, the workgroup recommends strengthening the *Guidelines* such that the chronic toxicity data requirements require that either:

1) Full life-cycle data be available for at least one fish species; or

2) There is a body of experimental information indicating that life processes outside the ELS or partial life-cycle exposure/observation windows would not be important to capturing the important toxicological effects of the chemical.

We note further that although this report is focused on CECs, this recommendation may be important to implement for all chemicals, not just CECs.

Regarding the latter, we recognize that there may be circumstances where the information that shows the sensitivity of different life stages comes from studies that, while scientifically valid, for some reason do not meet all the requirements of a valid life-cycle test as defined in the *Guidelines*. Alternatively, there may be data from experiments that violate other requirements of acceptable toxicity tests under the *Guidelines*, but still provide insight into sensitive exposure periods or life processes. Even though chronic values from such data may not be used directly to calculate a CCC, it seems a reasonable use of such data to evaluate the question of where in the life-cycle there are important windows of exposure and/or effect, and how that impinges on criteria derivation.

It may also be that meaningful chronic toxicity data could be developed from exposures that have a structure different from the life-cycle, partial life-cycle, and ELS protocols defined explicitly in the *Guidelines*; e.g., a short-term (21-day) reproduction assay with the fathead minnow (U.S. EPA 2001) or a multi-generational study – see example for EE2 reported in Nash et al. (2004). While defining such alternate protocols is beyond the scope of this document (see Ankley and Johnson 2004 for more detail), we recognize the potential for such a situation and leave it to appropriate implementation of the "Good Science" clause to allow for inclusion of such alternative test protocols as surrogates for chronic toxicity data, most likely in addition to, rather than instead of, data from life-cycle toxicity tests.

4.5 Selection of Effect(s) Endpoints Upon Which to Base ALC

Although chronic criteria typically are based on direct effects on reproduction, growth, and survival, there may be other endpoints indirectly related to these responses that could be useful for criteria derivation. The selection of endpoints appropriate to the derivation of ALC must be tied to the narrative intent of the overall *Guidelines*. The stated goal of ALC is to "protect aquatic organisms and their uses." While the exact meaning of "protection" is not defined, there is considerable discussion in the *Guidelines* document that makes clear that protection does not mean the prevention of any measurable biological effect in any organism. Instead, there is discussion of endpoints that are "biologically important" and prevention of "unacceptable effects"; this implies that in the context of criteria there are effects that are "biologically unimportant" and/or levels of effect that are "acceptable."

Chronic test data and other data should be examined to determine whether, for the specific chemical or MOA, endpoints beyond those traditionally used for criteria derivation may have intrinsic "biological importance" and therefore could be used as a basis for defining threshold of effect (e.g., sex ratio). Specifically, in the context of EDCs:

- Other "endocrine-sensitive endpoints" (e.g., VTG, testis-ova) should be examined to determine whether they can be relied upon as definitive indicators of other biologically important endpoints (e.g., reproduction), with the idea that they may be incorporated into calculation of the criterion. Important sources of this information would include full life-cycle tests in which these other endpoints were measured alongside traditional chronic endpoints, and may include tests with other chemicals with the same MOA (e.g., E2 for EE2).
- If endpoints, such as VTG or testis-ova, are used as direct or indirect indicators of effect, it is critically important that the baseline condition (e.g., variation during normal development) be understood sufficiently to define when changes are biologically meaningful.
- Selection of appropriate endpoints (and their associated effect thresholds) may, in some instances, transcend "biological importance" (the focus of the *Guidelines*) to reflect societal concerns (e.g., physical appearance of wild-caught fish).

4.6 Involvement of an Expert Panel

As becomes clear from the preceding issues, development of appropriate criteria for CECs may be unusually dependent on technical interpretations of a wide range of toxicological information pertinent to specific chemicals. One of the recommendations from a SETAC Pellston workshop (Mount et al. 2003), consistent with much of the above, was that expert panels be used to provide professional judgment during stages of the problem formulation and data interpretation associated with criteria development, particularly for chemicals with specific MOA. The involvement of the panel would "ensure consideration of other existing data for the chemical of concern, enable a significant degree of up-front technical input, and provide a level of peer review that should facilitate wider and more ready acceptance of the recommended criteria." The workgroup agrees with this recommendation and suggests that it be incorporated into criteria development of CECs.

To maximize effectiveness, this panel should be convened very early in the criteria development process such that it will be able to assist in problem formulation, identification of important data, and scoping of particular issues that will be important. We envision these panels as being formed around specific chemicals, or groups of chemicals with a similar MOA, in order to access the most specialized expertise available.

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WHITE PAPER

AQUATIC LIFE CRITERIA FOR CONTAMINANTS OF EMERGING CONCERN

PART II

ILLUSTRATION OF RECOMMENDATIONS USING DATA FOR 17α-ETHYNYLESTRADIOL (EE2)

Prepared by the
OW/ORD Emerging Contaminants Workgroup

June 03, 2008

NOTICE
THIS DOCUMENT IS AN INTERNAL PLANNING DOCUMENT
It has been prepared for the purpose of Research & Development Planning.
It has not been formally released by the U.S. Environmental Protection Agency and should not at this stage be construed to represent Agency guidance or policy.

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1.0 INTRODUCTION

In Part I of this white paper, toxicological characteristics of some contaminants of emerging concern (CECs) important to the derivation of ambient water quality criteria for aquatic life (aquatic life criteria, ALC) were described, and recommendations were made to facilitate ALC derivation for these chemicals. In Part II of this white paper, toxicity data for a model CEC, 17α-ethynylestradiol (EE2), are used to further illustrate and explore those recommendations. Ethynylestradiol was chosen as a model compound for a several reasons. First, it possesses many of the toxicological characteristics described in Part I, and sufficient toxicity data exist to allow evaluation of the principles underlying the Part I recommendations. Second, toxicological effects of EE2 have been found both in the laboratory, the source of toxicological data for criteria development, and in the field, where criteria are used to enforce the regulatory authorities of the Clean Water Act. Finally, there is interest in deriving an EE2 ALC, and using EE2 as a basis for discussion should help advance that goal. While acknowledging that interest, it is important to note that the data and discussion presented are not intended to represent the formulation of an actual ALC, and potential ALC concentrations should not be inferred. The information from the ecotoxicological literature used here is for illustrative purposes and should not be considered as comprehensive, nor have all the data been fully examined for quality and applicability to ALC development.

The synthetic estrogenic steroid EE2 is the active pharmacological component of most oral contraceptives, and acts as a potent estrogen receptor agonist in vertebrates. After use and excretion of the contraceptive, domestic sewage treatment plant (STP) effluents become the primary source of EE2 entering the aquatic environment (Damstra 2002). Kolpin et al. (2002) found EE2 in 5.7% of 139 streams monitored in the U.S. While the concentrations of EE2 in Kolpin et al. (2002) have been debated (Ericson et al. 2002; Till 2003), other studies have noted concentrations ranging from 0.1 – 5.1 ng/L in surface waters (as reviewed by Campbell et al. 2006). Overall, it is somewhat uncertain at this time how high environmental concentrations of EE2 may be. Reliable analytical methods for the detection of EE2 have not been in existence very long, nor have they been widely validated in independent multi-laboratory studies. Some modeling efforts by the pharmaceutical industry indicate that based on the level of production and use of EE2 in the U.S., concentrations found in effluents should be less than 1 ng/L (Anderson, P.D. and D'Aco, V, personal communication, 2008). Complicating assessment of the possible risk of EE2 is the fact it co-occurs in STP effluents with the natural steroid hormones estradiol and estrone, though EE2 is generally found at lower concentrations. These three estrogens reportedly account for the majority of the estrogenic activity present in domestic wastewater effluents (Desbrow et al. 1998; Snyder et al. 2001), but EE2 is the most potent and resistant to degradation of the three (Nash et al. 2004; Gross-Sorokin et al. 2006). Data collected from fish and surface waters downstream of STPs over the past decade have implicated steroidal estrogens as the primary constituents in domestic effluents leading to the occurrence of intersex fish (Gross-Sorokin et al. 2006).

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The remainder of this part of the white paper consists of a brief description of some relevant acute and chronic toxicity data available for EE2 (Section 2) and the evaluation of these data with respect to the recommendations made in Part I (Section 3).

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2.0 DESCRIPTION OF THE ACUTE AND CHRONIC TOXICITY DATA SUMMARIZED FOR EE2

Acute and chronic toxicity data were identified via a literature search and review of relevant articles from EPA's ECOTOX database in April 2007. This list of potentially useful articles was supplemented with a few additional reports and articles as they became published or available. Only those studies with EE2 effect data on individual aquatic organisms or their populations were retained. For this particular effort, all endpoints expressing effects of EE2 at the whole animal and cellular levels were initially considered. Because the EE2 dataset is relatively large, and because many studies report more than one endpoint of possible consideration for ALC development, the data have been broadly summarized in an appendix (Appendix A). The tables comprising Appendix A are organized by endpoint, and include separate tables for endpoints typically used to derive ALC (survival, growth and reproduction) as well as for other endpoints relevant to the estrogenic mode of action of EE2. Table A.1 contains the data available on the acute (lethal) toxicity of EE2 to aquatic animals. This table is followed by others containing the chronic (long-term) effects of EE2 on survival (Table A.2) and growth of aquatic animals (Table A.3). Tables A.4 through A.9 present data directly (fecundity, fertility) or indirectly (sex reversal, intersex, sexual behavior, vitellogenin) related to the effects of EE2 on reproduction. Finally, Table A.10 presents a summary of the significant effects of EE2 on aquatic animals based on other potentially relevant endpoints. *In vitro* effects were not considered in the data analysis.

Within each table in Appendix A, data are first separated by studies where significant effects were observed, and then by studies where significant effects were not observed (i.e., where no effect was observed at the highest concentration tested). Each table in the appendix combines data for aquatic vertebrates and invertebrates for both freshwater and saltwater species, the latter designated by asterisks. All tables are organized by increasing effect concentrations, and all chronic effect endpoints are as reported by the authors.

Many studies of the effects of EE2 on aquatic organisms did not use standard toxicity test protocols, particularly those measuring sublethal responses. This is probably due in part to these studies having been designed for purposes other than ALC development, such as exploration of toxicity mechanisms, identification of sensitivity windows, bioassay development, etc. Adequate quantification of effect concentrations is also difficult for some of these studies because of the use of widely spaced treatment concentrations and by problems with analytical detection of exposure concentrations near the threshold for reproductive effects. While the results from such studies might limit their use in ALC development according to the definitions in the *Guidelines*, they were included in this document because they may inform other aspects of criteria derivation, as explained in general terms in Part I and in detail in the sections that follow.

3.0 EE2 DATA EVALUATION AND CONSIDERATIONS FOR ALC DEVELOPMENT

This section considers the application of the data in Appendix A toward criteria derivation in the context of the several areas of concern and general recommendations identified in Part I of this white paper.

3.1 RELEVANCE OF ACUTE TOXICITY EFFECT LEVELS IN SETTING ALC FOR EDCS

One of the recommendations from Part I of this document was to determine whether the acute sensitivities of aquatic organisms to a chemical of interest are sufficient, relative to chronic sensitivity and expected exposures, to warrant derivation of a criterion maximum concentration (CMC) under the *Guidelines* procedures. This is especially important if there is not sufficient acute toxicity data to meet the minimum data requirements of the *Guidelines*, in order to avoid wasting resources on unnecessary additional testing. EE2 provides a good example of a chemical having insufficient acute toxicity data to derive a CMC according to *Guidelines* procedures, but enough data to demonstrate that deriving a CMC is not necessary.

Table 3.1 provides information on GMAVs that might be considered in CMC derivation. These values were derived from Table A.1 for any tests meeting *Guidelines* requirements, including "greater than" values indicative of the highest tested concentration eliciting less than 50% mortality. For genera without such acceptable tests, EC50/LC50s from Table A.1 for tests of 24 h duration and from Table A.2 for tests up to 30 days were also used. The EC50/LC50 values for these longer tests are designated as "greater than" values to indicate the expectation that acute EC50/LC50s would be higher. Values for medaka and zebrafish are included in accordance with the recommendation from Part I of this document that some latitude be adopted regarding species not resident to North America. Acute tests with embryos, not usually included in CMC calculations, are also included here because they suggest greater sensitivity of this life stage.

Table 3.1. Potential GMAVs for Application to EE2 CMC.

Genus	GMAV (ng/L)	Comments
	Freshwater	
Rana	>760,000	14-d test
Gammarus	>840,000	10-d test
Medaka	>1,000,000	
Danio	1,700,000	
Ceriodaphnia	1,800,000	
Hydra	3,800,000	
Sida	>4,100,000	24-h test

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Genus	GMAV (ng/L)	Comments
Daphnia	>5,000,000	
Chironomus	9,100,000	24-h test
Saltwater		
Lytechinus	30,000	Embryo
Strongylocentrotus	30,000	Embryo
Acartia	88,000	Embryo
Tisbe	>100,000	21-d test
Acartia	1,100,000	
Neomysis	1,200,000	

The data summarized in Table 3.1 show several deficiencies in meeting the minimum data requirements for deriving a CMC under the Guidelines. For freshwater application, only four genera, rather than the minimum of eight, meet the acute test requirements, even if the prohibition for non-resident species is ignored. If the shorter and longer tests are included, the requirement of at least eight genera is met, but the requirement for a salmonid fish is not. Even if this requirement is also ignored, two of the lowest four genera are "greater than" values, whereas CMC calculations can only be made if the four most sensitive genera have definite values ("greater than" values are permitted only for more tolerant genera.) For saltwater, there are even greater deficiencies in meeting the minimum data requirements.

Although these data are insufficient for deriving CMCs, they do provide ample evidence that a CMC is not needed and that it is unnecessary to conduct further tests to meet the minimum data requirements. For freshwater, there is still a rather broad taxonomic representation, including three vertebrates from two different classes, four crustaceans from two orders, and a third phylum. The acute LC50s/EC50s are consistently near and above 1 mg/L, several orders of magnitude above both the most sensitive chronic endpoints (Tables A.4 – A.9) and the highest environmental concentrations that organisms might be exposed to. The saltwater data do show greater sensitivity for the embryonic stages of some genera, but whether this reflects a lifestage or taxa sensitivity issue, these LC50s/EC50s are still four orders of magnitude above the most sensitive chronic endpoints and environmentally-relevant exposures.

3.2 USE OF NON-RESIDENT SPECIES IN ALC DEVELOPMENT

Under the *Guidelines*, toxicity values from aquatic species not resident to the contiguous 48 United States, Alaska, or Canada are excluded from ALC derivation. One of the recommendations in Part I of this white paper is that this prohibition be relaxed and that data for non-resident species be allowed where deemed suitable, especially for species such as medaka and zebrafish which have become standard test organisms commonly used worldwide. Any tested species, whether resident or not, serves as a surrogate for estimating a sensitivity

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distribution relevant to assessing risks in a variety of aquatic communities with a multitude of untested species. Therefore, the issue here is whether a non-resident species can serve as a reasonable surrogate for assessing the sensitivity of untested resident species. The use of such species would still be contraindicated if there is reason to believe they are significantly more or less sensitive than resident species.

The data in Appendix A support the use of medaka and zebrafish data in criteria calculations. Although there are no resident fish species with which to compare the acute sensitivities of medaka and zebrafish (see Table 3.1 and Table A.1), their lack of acute sensitivity is consistent with that of resident amphibians and invertebrates in the available data. The sensitivities of these fish species for long-term survival (Table A.2), growth (Table A.3), and reproduction (Table A.4) are interspersed with those of resident fish species, so there is no indication of either substantially higher tolerance or sensitivity to contraindicate their use. This is also generally true of the other endpoints summarized in Appendix A. The similarity among fish species of different geographic origins is not surprising, since the MOA of EE2 involves receptors and pathways that are highly conserved among vertebrates. If similar trends are seen in the data once they are thoroughly examined for quality and applicability to ALC development, data from these non-resident species should be included in criteria development.

The data in Appendix A also underscore pragmatic advantages of including non-resident species in criteria development. Medaka and zebrafish provided a large fraction of the available data regarding EE2 effects on fish. Removing them from the dataset simply because they are not resident would limit information on the distribution of species sensitivity and may actually increase rather than decrease uncertainty regarding resident species. Another use of data from non-resident species could be to assist in extrapolations of information across species, chemicals, and endpoints. For example, life-cycle tests with medaka could be used to evaluate whether early life-stage or partial life-cycle tests with resident species should or should not be accepted in criteria calculations for specific classes of chemicals with a defined MOA. The relationship of reproductive effects in non-resident fish (Table A.4) to other endpoints (Tables A.5-A.9) could also be used to determine how to apply information on these other endpoints for resident species lacking direct toxicological information on reproduction.

3.3 MINIMUM DATA REQUIREMENTS REGARDING TAXONOMIC COVERAGE

As discussed in section 3.1, deriving a CMC for EE2 is not useful because acutely-toxic concentrations are so much higher than both chronic effects concentrations and expected environmental concentrations. In addition, developing a CMC would require additional acute toxicity tests to meet the minimum data requirements (MDRs) specified in the *Guidelines*. Without a CMC, the criterion continuous concentration (CCC) must be calculated directly from the available data, rather than through extrapolation using an acute to chronic ratio (ACR); this is probably not advisable anyway for such large ACRs. Since the ACR method is moot, the *Guidelines* calculation procedures for the CCC require that there be sufficient chronic toxicity tests to satisfy the MDRs for estimating the fifth percentile of the chronic database. For

freshwater criteria, these MDRs include a species from: the family Salmonidae; a species from a second family in the class Osteichthyes; a species from a third family in the phylum Chordata; a planktonic species from the Class Crustacea; a benthic species from the Class Crustacean; a species from the Class Insecta; a species from a phylum other than Chordata or Arthropoda; and a species from an order of insects or a phylum not otherwise represented.

Few existing ALC have chronic data that meet the MDRs, and this will likely be true of CECs as well. Significant expense would be incurred conducting new chronic tests to satisfy all the requirements. As recommended in Part I of this white paper, because only the four most sensitive genus mean chronic values (GMCVs) are used in the criteria calculations, chronic testing requirements for a taxon needed to meet an MDR should be waived if there is sufficient information to conclude that this taxon is more tolerant than the four most sensitive genera. A value (or values) for this taxon would still be included in the data set, but its GMCV would simply be specified to be greater than the fourth lowest GMCV.

Table 3.2 lists chronic values for the toxicity of EE2 to various freshwater genera to illustrate data that might be included in freshwater criteria calculations. These chronic values were obtained from Tables A.2-A.4, using *Guidelines* data selection procedures where possible, but also included some additional data to support discussion of how certain data deficiencies might be addressed. For invertebrates, the *Guidelines* require life-cycle tests that include reproductive endpoints, but if that type of test was not available, then other tests are reported here, with their limitations noted. For fish, the *Guidelines* preference order of life-cycle, partial life-cycle, and early life stage (ELS) was followed, but other tests were also reported as needed for illustrative purposes, with their limitations also noted. For all genera, the most sensitive endpoint among chronic survival, growth, and reproduction was selected, which was from the reproduction data of Table A.4, except for *Chironomus* (for which development from egg to pre-emergence was tested and the effects concentration was from Table A.3). Each chronic value (CV) was calculated as the geometric mean of the reported no observed and lowest observed effect concentrations (NOEC and LOEC) for an adverse effect. When the LOEC was the lowest exposure concentration, a "less-than" concentration is reported for the CV and, when the NOEC was the higher exposure concentration for insensitive species, a "greater-than" concentration is reported. As explained in Sections 1 and 2, these data are still under review and subject to modification. The specific values here should not be misconstrued as final, but rather as examples to illustrate trends and indicate needs that support the recommendations being addressed here.

Table 3.2. Potential Chronic Values for Application to EE2 CCC.

Genus	CV(s) (ng/L)	Notes
Danio	0.6, 1.5, <1.1	Life-cycle tests; for 1.5 ng/L CV, there was a 9-fold difference between LOEC and NOEC and the LOEC was a 100% effect
Pimephales	<0.32, 1.5	Life-cycle tests; for <0.32 ng/L CV, LOEC showed reduced fertilization but increased egg production so total reproduction not adversely affected; for 1.5 CV, 4-fold difference between NOEC and LOEC
Oryzias	3.2	F_0 from 1 d through spawning; 10-fold difference between NOEC and LOEC
Oncorhynchus	<16	Adult exposure only; fertilization success only endpoint examined
Potamopyrgus	50	Adult exposure only; embryo production over 9 wk test
Gammarus	>7,600	Population size over 100 d test; increased population size at 760 and 7,600 ng/L
Daphnia	45,000	5-fold difference between NOEC and LOEC
Tisbe	>100,000	Saltwater copepod included to further indicate arthropod insensitivity
Chironomus	320,000	Larval growth and molting schedule only; did not include emergence and reproduction
Brachionus	800,000	Intrinsic rate of population increase over 72 hr test

The data in Table 3.2 indicate high sensitivity of vertebrates to EE2. Significant reproductive effects in the life-cycle tests for zebrafish (*Danio rerio*) and fathead minnow (*Pimephales promelas*) occur at concentrations near and perhaps below 1 ng/L. Although the chronic test for medaka (*Oryzias latipes*) did not cover the entire life cycle, it included life stages likely important for reproduction and indicated a sensitivity similar to zebrafish and fathead minnow. For rainbow trout (*Oncorhynchus mykiss*), a more limited exposure addressing only effects on fertilization suggests that reproductive effects on this species should also be present in the low ng/L range. However, the absence of a definite toxicity value for rainbow trout will be an important impediment to criteria calculations, both for leaving an MDR unsatisfied and for being one of the four most sensitive genera in this set. Actual criteria development will require a decision whether to (a) require more information for this species, (b) use other information to help estimate rainbow trout sensitivity or (c) justify setting the MDR aside (see Section 3.5).

The invertebrate data in Table 3.2 indicate lower sensitivity, especially for arthropods (*Gammarus, Daphnia, Tisbe, Chironomus*) and rotifers (*Brachionus*). Some data, like the *Chironomus* test, fail to satisfy the *Guidelines* requirement for a life-cycle test and the copepod *Tisbe* is a saltwater species included here only to reinforce conclusions about arthropod sensitivity. Also, the tests for *Gammarus* and *Brachionus* are not standard life-cycle tests, but could be considered to satisfy *Guidelines* requirements because exposures span a life cycle and

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include reproductive effects. The snail (*Potamopyrgus*) toxicity test showed moderate sensitivity, although still about an order of magnitude less than the fish, and also does not involve a full life-cycle test.

These data demonstrate the potential for a situation in which the GMCVs for taxa reasonably expected to be insensitive do not need to be quantified. For example, although the *Chironomus* test was not a full life-cycle test and thus could not fully define the GMCV under *Guidelines* requirements, it indicates such a degree of insensitivity for growth and development, such that it can be reasonably presumed that a full life-cycle test would still show much less sensitivity than the vertebrates, especially because other arthropods are observed to be similarly insensitive. Likewise, the snail test, although not for a full life-cycle, involved the effects of long exposures on reproduction, and can be argued to be sufficiently less sensitive than fish reproduction so that it would not reasonably be expected to be among the four most sensitive genera if a life cycle test was conducted. These inclusions, along with the data for *Daphnia*, *Gammarus*, and *Brachionus*, satisfy the *Guidelines* MDRs for invertebrates, and would allow an ALC to be calculated from the four sensitive vertebrate genera, provided the value for the rainbow trout was resolved.

Assessing that taxa are likely to be insensitive could involve other lines of evidence, especially for CECs with more limited chronic toxicity data than EE2. Tests involving endpoints such as those in Tables A.5-A.10 could be used to establish that certain taxa are sufficiently less sensitive than others to preclude the need for tests on their chronic survival, growth, and reproduction (Tables A.2-A.4), the endpoints typically used in ALC development. Information from other chemicals might also be used, such as using the insensitivity of arthropods to EE2 to preclude testing this taxonomic class with chemicals with the same MOA. Such a strategy could be used to help the evaluation of EE2, particularly regarding the snail sensitivity. For example, the sensitivity of this or similar species relative to that of vertebrates for other chemicals could be used to strenghten a conclusion that they are less sensitive to EE2 than are fish.

3.4 DEFINING APPROPRIATE CHRONIC TOXICITY DATA

As discussed in Part I of this white paper, characteristics of some CECs require that careful consideration be given to the selection of chronic toxicity data appropriate for ALC development. Specifically, the use of data from early-life stage (ELS) or partial-life cycle (PLC) exposures as estimates of life-cycle chronic effect thresholds is inadvisable for chemicals whose MOA would result in biological effects for which critical periods of induction and/or expression would lie outside the exposure/observation window provided by the test procedure.

An examination of data specifically for EE2 provides evidence to support emphasis on full life-cycle exposures for determining the chronic toxicity of EE2. Länge et al. (2001) conducted a full life-cycle chronic exposure with fathead minnows which were exposed from fertilized eggs (F_0) through maturation, spawning, and early-life stage development of the F_1 generation. Nominal exposure concentrations of EE2 were 0.2, 1, 4, 16, and 64 ng/L (for convenience, nominal concentrations are used in this discussion as the important point is relative endpoint sensitivity

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rather than absolute concentrations inducing effects). As part of this exposure, measurements of growth (as length) and survival were made at 28 days post hatch (dph) which would correspond to the end of a standard ELS exposure with fathead minnows. At 28 dph, there were no effects on survival. The length endpoint showed a 16% reduction at 64 ng/L, a smaller but significant reduction of 6% at 16 ng/L, and no effect at 4 ng/L. Accordingly, the NOEC and LOEC for an ELS test with EE2 would have been 4 and 16 ng/L, respectively, and an EC20 based on length would be >64 ng/L. However, as exposure continued throughout the life cycle, pronounced effects were observed for other endpoints at lower exposures. There was no reproduction at all in fish exposed to 4 ng/L, and a trend, though not significant, toward lower reproduction at 0.2 and 1 ng/L. Other significant effects observed included a 16% reduction in weight of adult female fish at 1 ng/L after 301 d exposure, and 5 to 10 percent reductions in weight of F_1 offspring at 28 dph, though the authors questioned the biological significance of the F_1 growth effects. Regardless, the clear indication is that life-cycle exposure showed substantially greater sensitivity to EE2 than was evidenced from ELS endpoints alone. This was much larger than the factor of 2 difference generally found for other chemicals by McKim et al. (1978).

A similar conclusion can be drawn from the study of Parrott and Blunt (2005). This involved exposure from fertilized egg through reproduction, including measures of fertilization success (but not ELS development) in the F_1 generation. Exposure was to nominal concentrations of 0.32, 0.96, 3.2, 9.6, and 32 ng/L EE2. Measurements of survival and growth at 30 dph showed no effects (NOEC $\geq$ 32 ng/L). However, continuation of exposure through adulthood showed no reproduction in the 3.2, 9.6 and 32 ng EE2/L treatments, and all fish in these treatments were phenotypic females. There was also suggestion of effects on fertilization success at 0.32 and 0.96 ng/L, although interpretation of these effects is complicated by an increase in number of eggs produced in these same treatments, such that the total number of fertilized eggs was not as dramatically affected. Regardless, the message relative to definition of chronic sensitivity is the same in that effects were apparent after life-cycle exposure at concentrations well below those that would be expected to show effects in an ELS test.

Additional comparisons can be extracted from the work of Wenzel et al. (2001), who conducted a multi-generational study of zebrafish exposed to EE2 concentrations from 0.05 to 10 ng EE2/L. Observations of survival and length of exposed fish showed no effects at 21 and 42 dph (NOEC $\geq$10 ng/L). However, with continued exposure, a variety of effects were observed around an EE2 test concentration of 1 ng/L, including effects on adult length, time to spawning, egg production and fertilization. As for the fathead minnow studies, survival and growth measured during the period comparable to an ELS study were far less sensitive to EE2 exposure than were endpoints measured in full life-cycle studies (Tables A.2, A.3, A.4).

The reason for these differences between ELS and full life-cycle tests is obvious when one considers the MOA for EE2, which interferes with sexual differentiation, development, maturation, and spawning. Because the endpoints measured in ELS tests are limited to survival and growth, and because the effects of EE2 on sexual differentiation are not apparent (at least not at a gross morphological level) in the tested species by 28-30 dph, the ELS test is comparatively insensitive to toxicity mediated through an estrogen receptor signaling pathway. It is interesting

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to note that even though a standard ELS test is relatively insensitive to detecting the effects of EE2 exposure, other work has shown that key windows of exposure do in fact occur during the ELS exposure window. Van Aerle et al (2002) demonstrated that larval fathead minnows exposed to EE2 only during brief windows during early development (e.g., 10-15 dph) showed altered sexual development of male fish at 100 dph, including the development of an ovarian-like cavity and changes in the distribution of testicular cell types (Table A.6). The issue for interpreting chronic toxicity data is that, even though effects may be induced during ELS exposure, they are not expressed unless exposed fish are observed later in sexual development.

This latter observation also has implications for the suitability of PLC tests for detecting the effects of EE2 or other chemicals acting through a similar pathway. As discussed in the *Guidelines*, PLC tests are acceptable chronic tests for fish species that require more than one year to reach sexual maturity, such as the common species of trout. PLC tests are to begin exposure "with immature juveniles at least 2 months prior to active gonad development, continue through maturation and reproduction, and end not less than 24 days (90 days for salmonids) after the hatching of the next generation." If salmonids (or other species for which PLC tests might be conducted) were to express effects from larval exposure to EE2 as observed by Van Aerle et al. (2002) for fathead minnows, one would expect that a PLC exposure would not be as sensitive as a full life-cycle exposure. That is, even though a PLC test includes the observation periods shown to be sensitive in full life-cycle exposures, it might not include the exposure windows important to inducing chronic effects on sexual differentiation and development.

While the rationale for emphasizing full life-cycle chronic tests has clear grounding in the MOA for EE2, it has practical implications in terms of the fish species likely to be tested. Most species for which life-cycle chronic tests are most commonly conducted (primarily fathead minnow, zebrafish, medaka, flagfish, and sheepshead minnow), are small fish that develop rapidly and are continuous spawners (as opposed to annual spawners like rainbow trout or bluegill sunfish). Whether or not these life history traits influence sensitivity to EE2 is unknown, but because of the investment necessary to conduct true life-cycle exposures with annually spawning fish that take much longer to develop, it may be unlikely that comparative data will be developed. Better understanding these implications is a worthy subject for future research.

Finally, there are some scattered indications in the literature for trans-generational effects of EE2 exposure. As mentioned above, Länge et al. (2001) found small effects on growth in the F_1 generation that were not observed after comparable exposure of the F_0. Wenzel et al. (2002) also report some suggestions of growth inhibition in subsequent generations at exposure below those causing such effects in the first exposed generation (Table A.3). The mechanisms by which such effects might occur are not clear, nor are their implications (in fact, Länge et al. actively dismiss them as being biologically unimportant). At this point, it does not seem that the evidence for trans-generational effects is sufficient for requiring their inclusion in the definition of an acceptable chronic test, but the potential for the existence and importance of trans-generational effects should be re-evaluated in the future as additional data become available.

3.5 SELECTION OF EFFECT(S) ENDPOINTS UPON WHICH TO BASE ALC

Aquatic studies with EE2, particularly those using fish, have measured a variety of endpoints not traditionally used for criteria derivation, including reproductive behavior, abnormal sex ratios, changes in secondary sexual characteristics, altered histopathology (typically gonadal), changes in steroid hormones, and modifications in the expression (or activity) of a variety of proteins/enzymes. Many of these endpoints were evaluated because they are known (or hypothesized) to be responsive to estrogenic MOA, and not because the intended result was the quantitative assessment of risk. Among the challenges in using data from these types of mechanism-based endpoints is that such measurements are seldom standardized or straightforward in their interpretation. For example, alterations in behavior are difficult to objectively quantify, it is challenging to accurately measure steroid hormone concentrations in small fish, and the capability of measuring gene expression or enzyme activity can be quite lab/method-specific. A second source of uncertainty in using most of the mechanism-specific endpoints evaluated in EE2 studies is a lack of knowledge concerning the functional relationship between changes in endpoints and responses of primary concern for risk assessment, such as survival, growth and reproduction. Even in considering these challenges related to measurement and interpretation, however, there are a handful of mechanistic endpoints/responses that exhibit utility for supporting ALC derivation for EE2 (or other xenobiotic compounds with estrogenic activity). Three of these are discussed in greater detail below.

A frequently measured mechanism-specific endpoint in fish exposed to EE2, is induction of vitellogenin mRNA (*vtg*) or expression of circulating vitellogenin protein (VTG) in males (Table A.9). The most attractive attribute of this endpoint is its specificity for an estrogenic MOA, since there are no other chemically linked biological phenomena known to consistently activate the vitellogenin gene or elevate vitellogenin protein in male fish. Further, since the vitellogenin gene is quiescent in male fish, which implies a zero baseline of vitellogenin, the response is unambiguous with regard to exposure. Additionally, this exposure mediated induction of *vtg* is sensitive to low levels of exogenous estrogen. Because vitellogenin protein has been frequently evaluated in fish studies, accurate methods of measurement (including several commercial kits) are available for many fish species, including the small fish models for which much of the EE2 chronic toxicity data exist. Given these attributes, male VTG has and should continue to be a very useful endpoint for monitoring the occurrence of estrogenic chemicals (including EE2) in the environment. A major drawback to using male-specific circulating protein to assess exposure and risk of EE2 (or other estrogens), including the derivation of ALC, is the lack of an established functional linkage between expression of the protein and adverse endpoints related to early development or reproduction (Wheeler et al. 2005). This is in large part due to the fact that VTG plays no physiological role in male reproductive processes. As such, any associations that might exist between VTG induction in males and reproductive success is likely more correlative than causal.

Despite the fact that the appearance of VTG in males appears not to be a robust predictor of adverse effects on reproduction, the response could nonetheless play an important role in reducing the uncertainty of ALC for EE2, or the development of ALC for other chemicals which

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might be estrogenic. From Table 3.2 above, it is apparent that data from life-cycle tests with fish would be appropriate (and critical) to setting the final ALC for EE2 and, by extension, other estrogens. Hence, knowledge that a less well-studied chemical than EE2 induces VTG in males could be used to help identify those instances when one (or more) life-cycle fish assay(s) would be recommended for generating robust data for ALC derivation. Another possible use of protein data, that could have more direct applicability to developing an ALC for EE2, involves use of the endpoint as a basis for evaluating relative species sensitivity. Specifically, reproductive data suitable for an EE2 ALC are largely from three species: fathead minnow, medaka and zebrafish (Table 3.2); however, there are studies with numerous species that have evaluated the ability of EE2 to induce vitellogenin mRNA and protein in males. Provided that a common dose metric could be established across these studies, a dataset could be developed to provide an indication of the relative sensitivity distribution of fish species to EE2, in addition to other estrogens. This would enable a direct comparison of values along the continuum of estrogen sensitivity for those fish species wherein chronic data exist (based on VTG induction) and, as such, could provide a quantitative indication of uncertainty for a proposed EE2 criterion.

There are two mechanism-specific endpoints that have been measured in a number of EE2 studies that might, with additional research and analysis, have a direct bearing on criteria derivation: alterations in sex ratio (i.e., generation of genotypic males with a female phenotype) and the occurrence of intersex/testis-ova (Tables A.5, A.6). As opposed to VTG induction in males, the functional linkage between skewed sex ratios or abnormal gonad development and reproductive success in fish, at both the individual and population levels, is readily apparent. Specific endpoints, however, can be difficult to measure. For example, detailed histological analyses are needed to identify and, especially, quantify testis-ova. To detect an alteration in sex ratio, a genotypic marker of gender (available in medaka but not fathead minnow or zebrafish) or a relatively large representative sample is required to reliably detect chemically-induced changes within a proportion of males and females in a population. Probably more difficult than measurement of the endpoints is definition of the quantitative linkage between changes in sex ratio or occurrence of testis-ova and effects on reproductive success for individuals and populations. For example, unless one assumes that any deviation in sex ratio from the norm (e.g., 1:1) is adverse, it is necessary to know (in the case of estrogenic effects) the magnitude of shift in respective gender numbers that is likely to result in cases where fewer young are produced. Similarly, it is probable that some degree of testis-ova would not be considered adverse in terms of reducing reproductive success, especially considering that the condition can exist at some degree, even in control animals (Grim et al. 2007). It is certain that at some level of manifestation, the condition will impair gonad function sufficiently such that acceptable levels of normal sperm cannot be produced. The frequency of this phenomenon, however, is currently unknown for any fish species. Definition of this relationship would support use of testis-ova occurrence in fish not only for prospective assessments (like criterion derivation), but in environmental monitoring studies focused on chemicals with an estrogenic MOA.

At present, uncertainties regarding measurement and interpretation hamper use of data from any of the mechanism-specific endpoints mentioned above as a basis for derivation of an ALC for EE2. Eith appropriate research, however, induction of vitellogenin in males, changes in sex

ratios and occurrence of testis-ova, all have the potential to contribute insights to different facets of quantitative risk assessment for estrogenic chemicals, including derivation of ALC. There is one noteworthy additional observation relative to use of non-traditional endpoints for an EE2 ALC. Several fish life-cycle studies using EE2 have been conducted in which typical measures of reproductive success (e.g., fecundity, fertility) have been made in conjunction with induction of VTG, sex ratio and/or testis-ova data (e.g., Länge et al 2001; Wenzel et al. 2001; Nash et al. 2004; Parrott and Blunt 2005). Although experimental design variables make some of the endpoint sensitivity comparisons challenging, it does not appear that there are substantial differences in EE2 test concentrations that produce adverse effects on egg production/fertility, versus those that alter the mechanism-specific endpoints. Hence from a pragmatic perspective, at least for the near-term, it seems reasonable to base an EE2 ALC on traditional measures of long-term reproductive success in fish.

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APPENDIX A

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Table A.1. Effects of EE2 on Aquatic Animals (Short-term survival).

Species	Life stage	Method	Duration	EC50 or LC50 (ng/L)	Reference	Remarks
Traditional Acute (1-7 day timeframe)						
*Sea urchin, *Strongylocentrotus purpuratus*	embryo	S,U	96 h	30,000	Roepke 2005	EC50 - abnormal development
*Sea urchin, *Lytechinus anamesus*	embryo	S,U	96 h	30,000	Roepke 2005	EC50 - abnormal development
*Copepod, *Acartia tonsa*	egg	R,U	5 d	88,000	Andersen et al. 2001	EC50-Inhibition of naupliar development
Medaka, *Oryzias latipes*	adult	-	96 h	>1,000,000	Thompson 2000	
*Copepod, *Acartia tonsa*	10-12 d adult	S,U	48 h	1,100,000	Andersen et al. 2001	
*Opossum shrimp, *Neomysis integer*	Juv, 2-4 mm	R, U	96 h	1,200,000	Verslycke et al. 2004	
Zebrafish, *Danio rerio*	adult	-	96 h	1,700,000	Wenzel et al. 2001	
Cladoceran, *Ceriodaphnia reticulata*		S,U	24 h	1,800,000	Jaser et al. 2003	EC50 mobility
Cnidarian, *Hydra vulgaris*	Adult male	R, U	96 h	3,800,000	Pascoe et al. 2002	
Cladoceran, *Sida crystallina*		S,U	24 h	>4,100,000	Jaser et al. 2003	EC50 mobility
Cladoceran, *Daphnia magna*	<24 h	S,U	48 h	>5,000,000	Goto and Hiromi 2003	
Midge, *Chironomus riparius*	4th instar	S,M	24 h	9,100,000	Lee and Choi 2006	

*Indicates saltwater species.

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Table A.2. Effects of EE2 on Aquatic Animals (Long-term survival).

Species	Life Stage	Method	Duration	NOEC-survival (ng/L)	LOEC - survival (ng/L)	Reference	Remarks
Significant Effect Observed							
Zebrafish, *Danio rerio*	1 d old	R,U	38 d	10	100	Orn et al 2006	100% mortality at LOEC
Zebrafish, *Danio rerio*	2 dph	R,U	58 d	10	100	Hill and Janz 2003	90% mortality at LOEC (45% control mortality); excess solvent
Medaka, *Oryzias latipes*	1 d	R,M	LC: 85 to 110 dph	29	290	Metcalfe et al. 2001	83% mortality at LOEC
*Sheepshead minnow, *Cyprinodon variegatus*	juv	F,M	PLC:59-7 dph F1	120	330	Zillioux et al. 2001	50% mortality at LOEC (42 days)
Medaka, *Oryzias latipes*	6 mo.	F,M	21 d	260	490	Seki et al. 2002	42% mortality at LOEC (4 of 5 dead males)
Rainbow trout, *Oncorhynchus mykiss*	1+ year	F,M	62 d pre-spawning	130	750	Schultz et al. 2003	100% mortality at LOEC (57 days)
Medaka, *Oryzias latipes*	4 mo.	R,U	14 d	500	2,000	Thompson 2000; Tilton et al. 2005	Significant mortality at LOEC
Zebrafish, *Danio rerio*	fert. eggs	R,U	5 wk	-	5,000	Ortiz-Zarragoitia et al. 2006	50% mortalty of exposed animals
*Copepod, *Tisbe battagliai*	<24 h	R,U	10 d	-	>100,000	Hutchinson et al. 1999	Value is an LC50
Wood frog, *Rana sylvatica*	Gosner 26	R,U	14 d	-	560,000	Hogan et al. 2006	Value is an LC50
Amphipod, *Gammarus pulex*	3-5 mm	R,M	10 d	-	840,000	Watts et al. 2001	Value is an LC50
Leopard frog, *Rana pipiens*	Gosner 26	R,U	14 d	-	890,000	Hogan et al. 2006	Value is an LC50
Leopard frog, *Rana pipiens*	Gosner 36	R,U	14 d	-	1,200,000	Hogan et al. 2006	Value is an LC50
No Signficiant Effects Observed (NOEC Equals Highest Test Concentration)							
*Sand goby, *Pomatoschistus minutus*	juv	F,U	7 mo	6	-	Robinson et al. 2003	
Fathead minnow, *Pimephales promelas*	fert eggs	F,U	125 d	10	-	Parrot et al. 2003	
Fathead minnow, *Pimephales promelas*	juvenile	F,M	21 d	20	-	Panter et al. 2002	Conc. only 40% of nominal

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Species	Life Stage	Method	Duration	NOEC-survival (ng/L)	LOEC - survival (ng/L)	Reference	Remarks
Chinese rare minnow, *Gobiocypris rarus*	7 mo	F,U	28 d	25	-	Zha et al. 2007	10% mortality
Zebrafish, *Danio rerio*	fert. eggs	F,U	3 mo	25	-	Van den Belt et al. 2003	40% mortality after 5 mo. recovery
Fathead minnow, *Pimephales promelas*	mature male	F,U	35 d	50	-	Schmid et al. 2002	
Snail, *Potamopyrgus antipodarum*	adult	R,U	9 wk	100	-	Jobling et al. 2004	
Medaka, *Oryzias latipes*	1 d	R,U	2 mo	100	-	Scholz and Gutzeit 2000	8% mortality
Zebrafish, *Danio rerio*	4 wk	R,U	33 d	100	-	Versonnen and Janssen 2004	6.6% mortality; excessive carrier solvent
Guppy, *Poecilia reticulate* (male)	< 7 d	F,M	108 d	110	-	Nielsen and Baatrup 2006	
Sturgeon, *Acipenser fulvescens*	1 yr	F,M	25 d	120	-	Palace et al. 2001	
Rainbow trout male, *Oncorhynchus mykiss*		F,M	3 wk	130	-	Hook et al. 2007	
African clawed frog, *Xenopus laevis*	adult	R,U	4 wk	2,960	-	Urbatzka et al. 2007	
Wood frog, *Rana sylvatica*	Gosner stage 25	R,M	76 d	4,100	-	Mackenzie et al. 2003	
Amphipod *Gammarus pulex*	mixed age	F,M	100 d	7,600	-	Watts et al. 2002	
Amphipod adult, *Hyalella azteca*	pre-copulatory	R,M	10 wk - 2 x gen	10,000	-	Vandenbergh et al. 2003	
*Copepod, *Tisbe battagliai*	<24 hr	R,U	21 d	100,000	-	Hutchinson et al. 1999	
*Copepod, *Tisbe battagliai*	<24 hr	R,U	21 d	100,000	-	Pounds et al. 2002	
Cladoceran, *Sida crystallina*		R,U	34 d	500,000	-	Jaser et al. 2003	
Cladoceran, *Daphnia magna*		R,U	25 d	500,000	-	Goto and Hiromi 2003	

*Indicates saltwater species.

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Table A.3. Effects of EE2 on Aquatic Animals (Growth).

Species Significant Effects Observed	Life Stage	Method	Duration	NOEC-growth (ng/L)	LOEC-growth (ng/L)	Reference	Remarks
Zebrafish , *Danio rerio*	fert egg	F,M	LC – F1	0.10	0.3	Wenzel et al. 2001	7% reduction at LOEC (75 dph)
Zebrafish , *Danio rerio*	fert egg	F,M	PLC	0.30	1.1	Wenzel et al. 2001	2% reduction at LOEC (78 dph)
Zebrafish, *Danio rerio*	20 dph	R,M	40 d	0.60	1.5	Orn et al. 2003	**Increased** juvenile wet weight
Fathead minnow, *Pimephales promelas*	<24 hr	F,M	LC	0.76	2.8	Länge et al. 2001	
Zebrafish , *Danio rerio*	fert egg	F,U	3 mo	1	10	Van den Belt et al. 2003	
Zebrafish, *Danio rerio*	2 dph	R,U	58 d	1	10	Lin and Janz 2006	
Fathead minnow, *Pimephales promelas*	embryo	F,M	114 d	-	12	Bogers et al. 2006b	
Chinese rare minnow, *Gobiocypris rarus*	7 mo	F,U	28 days	5	25	Zha et al. 2007	
Fathead minnow, *Pimephales promelas*	fert eggs	F,U	60 dph	10	32	Parrot and Wood 2002	
Zebrafish , *Danio rerio*	4 wk	R,U	33 d	10	100	Versonnen and Janssen 2004	Excessive carrier solvent
Guppy, *Poecilia reticulata*	<7d	F,M	108 d	44	112	Nielsen and Baatrup 2006	**Increased** adult wet weight.
Medaka, *Oryzias latipes*	1 day old	R,M	LC	29	290	Metcalfe et al. 2001	
Midge, *Chironomus riparius*	4th instar	S,U	48 hr	50	500	Lee et al. 2006	**Increased** larval dry weight
Midge, *Chironomus riparius*	1st instar	R,M	egg - pupa	100,000	1,000,000	Watts et al. 2003	
No Signficiant Effects Observed (NOEC Equals Highest Test Concentration)							
Zebrafish, *Danio rerio*	fert egg	F,M	2xGen	4.5	-	Nash et al. 2004	
*Three-spined stickleback, *Gasterosteus aculeatus*	fry	R,U	14 days	7.3	-	Hahlbeck et al. 2004b	

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Species	Life Stage	Method	Duration	NOEC-growth (ng/L)	LOEC-growth (ng/L)	Reference	Remarks
Fathead minnow, *Pimephales promelas*	fert eggs	F,U	60 dph	10	-	Parrot et al. 2003	
Fathead minnow, *Pimephales promelas*	juv	F,M	21 days	20	-	Panter et al. 2002	
Prosobranch mollusc, *Potamopyrgus antipodarum*	adult	R,U	9 wk	100	-	Jobling et al. 2004	
*Sheepshead minnow , *Cyprinodon variegatus*	juv	F,M	PLC	330	-	Zillioux et al. 2001	
Wood frog , *Rana sylvatica*	Gosner stage 25	R,M	76 d	4,100	-	Mackenzie et al. 2003	

*Indicates saltwater species.

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Table A.4. Chronic Reproductive Effects of EE2 on Aquatic Animals (Fecundity, Fertility, and Population Growth).

Species	Life Stage	Method	Duration	Endpoint	NOEC (ng/L)	LOEC (ng/L)	Reference	Remarks
Significant Effects Observed								
Fathead minnow, *Pimephales promelas*	40-60 h	F,M	LC	Percent fertilized of eggs laid	-	0.32	Parrott and Blunt 2005	
Zebrafish, *Danio rerio*	fert egg	F,M	LC	Number of fertilized eggs per female	0.30	1.1	Wenzel et al. 2001	
Fathead minnow, *Pimephales promelas*	<24 hr	F,M	LC	Mean no. eggs laid per breeding day	0.76	2.8	Länge et al. 2001	
Zebrafish, *Danio rerio*	fert egg	F,M	118 d	No. eggs spawned and prop fertilized	-	3	Fenske et al. 2005	
Fathead minnows, *Pimephales promelas*	-	Field	3 yrs	Population crash	-	3.2 – 8.9	Kidd et al. 2007	
Green frog, *Rana clamitans*	fert egg	Field	2 yr	Hatching success	-	3.2 – 8.9	Park and Kidd 2005	
Zebrafish, *Danio rerio*	fert egg	F,M	2 x gen	Proportion of non-viable eggs	0.50	4.5	Nash et al. 2004	Complete Rep. failure at LOEC
*Sand goby, *Pomatoschistus minutus*	juv	F,U	7 months	Fertile eggs and hatching success	-	6	Robinson et al. 2003	
Fathead minnow, *Pimephales promelas*	6-11 mo.	F,M	3 wk	Fert rate and no. eggs spawned	0.75	7.5	Pawlowski et al. 2004	**Increased** No. eggs spawned up to 0.75 ng/L
Zebrafish, *Danio rerio*	2 dph	R,U	60 d	% viable eggs, % hatch, % swim-up	1	10	Hill and Janz 2003	Excessive carrier solvent
Medaka, *Oryzias latipes*	1 d	R,U	2 mo	Female egg production	1	10	Scholz and Gutzeit 2000	No effect on male fert at 10 ng/L
Zebrafish, *Danio rerio*	fert egg	F,U	3 mo	No. spawning females & egg prod	1	10	Van den Belt et al. 2003	
Zebrafish, *Danio rerio*	8 mo	R,U	14 d	Absence of intact eggs in ovaries	1	10	Versonnen and Janssen 2004	
Rainbow trout, *Oncorhynchus mykiss*	1+ year	F,M	PLC	Fertilization success	-	16	Schultz et al. 2003	EC50; same response@131 ng/L
Snail, *Potamopyrgus antipodarum*	adult	R,U	9 wk	Embryo production	25	100	Jobling et al. 2004	EE2 at 25 ng/L stimulatory
*Sheepshead minnow, *Cyprinodon variegatus*	juv	F,M	PLC	Hatching success	18	120	Zillioux et al. 2001	
Medaka, *Oryzias latipes*	6 mo.	F,M	21 d	Fecundity	260	490	Seki et al. 2002	

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Species	Life Stage	Method	Duration	Endpoint	NOEC (ng/L)	LOEC (ng/L)	Reference	Remarks
Medaka, *Oryzias latipes*	4 mo.	R,U	14 d	Spawning frequency, % fertilized and % hatch.	5	500	Thompson 2000; Tilton et al. 2005	
Cladoceran, *Daphnia magna*	-	R,U	25 d	Embryo production	20,000	100,000	Goto and Hiromi 2003	
Rotifer, *Brachionus calyciflorus*		S,U	72 hr	Ratio of ovigerous/non-ovigerous females	202,000	510,000	Radix et al. 2002	
Rotifer, *Brachionus calyciflorus*		S,U	72 hr	Intrinsic rate population increase r	510,000	1,300,000	Radix et al. 2002	
No Signficiant Effects Observed (NOEC Equals Highest Test Concentration)								
Fathead minnow, *Pimephales promelas*	>6 mo.	F,M	3 wk	No. spawnings and eggs per spawn	1.5	-	Brian et al. 2007	
Mink frog, *Rana septentrionalis*	fert egg	Field	2 yr	Hatching success	3.2 – 8.9	-	Park and Kidd 2005	
Zebrafish, *Danio rerio* (females)	5-6 mo	R,U	15 d	Sterility in females	5,000	-	Ortiz-Zarragoitia et al. 2006	
Amphipod, *Gammarus pulex*	mixed ages	F, M	100 d	Population growth (total pop. size)	7,600	-	Watts et al. 2002	**Increase** in population size
*Copepod, *Tisbe battagliai*	<24 hr	R,U	21 days	Fecundity	100,000	-	Hutchinson et al. 1999	
*Copepod, *Tisbe battagliai*	<24 hr	R,U	21 days	Reproduction	100,000	-	Pounds et al. 2002	

*Indicates saltwater species.

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Table A.5. Chronic Reproductive Effects of EE2 on Aquatic Animals (Sex Reversal).

Species	Life Stage	Method	Duration	Effect	NOEC (ng/L)	LOEC (ng/L)	Reference	Remarks
Significant Effects Observed								
Zebrafish, *Danio rerio*	fert egg	F,U	3 mo	Delayed sexual differentiation	-	0.10	Van den Belt et al. 2003	No males at LOEC
Zebrafish, *Danio rerio*	20 dph	R,M	40 d	Male:female sex ratios	-	0.60	Orn et al. 2003	Complete sex reversal at 1.5 ng/L
Fathead minnow, *Pimephales promelas*	40-60 h old	F,M	LC	Male:femal sex ratio	0.32	0.96	Parrott and Blunt 2005	Complete ex. femin. at 3.5 ng/L
Fathead minnow, *Pimephales promelas*	fert. eggs	F,U	60 d	Male:female sex ratio	0.32	1.0	Parrot and Wood 2002	Complete ex. femin. at 3.2 ng/L
Zebrafish, *Danio rerio*	2 dph	R,U	58 d	Male:female sex ratio	-	1.0	Lin and Janz 2006	
Fathead minnow, *Pimephales promelas*	<24 hr	F,M	LC	Sex reversal - all female	0.76	2.8	Länge et al. 2001	Sex ratio at 0.76 ng/L 54:46
Zebrafish, *Danio rerio*	fert egg	F,M	42 d	Male feminization	-	3.0	Fenske et al. 2005	
Fathead minnow, *Pimephales promelas*	fert eggs	F,U	125 d	Sex reversal - all female	-	10	Parrot et al. 2003	
Zebrafish, *Danio rerio*	1 dph	R,U	60 d	Complete feminization	-	10	Orn et al 2006	
Zebrafish, *Danio rerio*	1 dph	R,U	60 d	Complete feminization	-	10	Yamani 2004	
Fathead minnow, *Pimephales promelas*	embryo	F,M	114 d	75% female gonads; 15% un-developed	-	12	Bogers et al. 2006b	
Zebrafish, *Danio rerio*	fert egg	R,M	60 d	Complete feminization	-	15	Andersen et al. 2003b	
Medaka, *Oryzias latipes*	1 d	R,M	LC	Male:female sex ratio	2.9	29	Metcalfe et al. 2001	
*Three-spined stickleback, *Gasterosteus aculeatus*	Larvae	R,U	42 d	Sex reversal and intersex	-	50	Hahlbeck et al. 2004a	
Medaka, *Oryzias latipes*	1 d	R,U	2 mo	Sex reversal with ovary	10	100	Scholz and Gutzeit 2000	
Medaka, *Oryzias latipes*	1 d	R,U	60 d	88% female, 2% male, 10% intersex	10	100	Yamani 2004 and Orn et al 2006	
Amphipod, *Gammarus pulex*	mixed ages	F, M	100 d	Male:femal ratio	-	104	Watts et al. 2002	No dose-response >104 ng/L

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Species	Life Stage	Method	Duration	Effect	NOEC (ng/L)	LOEC (ng/L)	Reference	Remarks
Guppy, *Poecilia reticulate*	< 7 d	F,M	108 d	Male:female sex ratio	44	110	Nielsen and Baatrup 2006	
No Signficiant Effects Observed (NOEC Equals Highest Test Concentration)								
Green frog, *Rana clamitans*	fert egg	Field	2 yr	Male:female sex ratio	3.2 – 8.9	-	Park and Kidd 2005	
Mink frog, *Rana septentrionalis*	fert egg	Field	2 yr	Male:female sex ratio	3.2 – 8.9	-	Park and Kidd 2005	
Amphipod, *Hyalella azteca*	adult	R,M	10 wk; 2 gen	Male:femal sex ratio	10,000	-	Vandenbergh et al. 2003	
*Copepod, *Tisbe battagliai*	<24 hr	R,U	21 d	Male:female sex ratio	100,000	-	Hutchinson et al. 1999	
Cladoceran, *Daphnia magna*	-	R,U	25 d	Male:female ratio	500,000	-	Goto and Hiromi 2003	

*Indicates saltwater species.

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Table A.6. Chronic Reproductive Effects of EE2 on Aquatic Animals (Intersex).

Species	Life Stage	Method	Duration	Effect	NOEC (ng/L)	LOEC (ng/L)	Reference	Comments
Significant Effects Observed								
Pearl dace, *Margariscus margarita*	mature	Field	3 yr	Presence of testis-ova	-	3.2 – 8.9	Palace et al. 2006	Edema in ovaries
Fathead minnows, *Pimephales promelas*		Field	3 yr	Presence of testis-ova	-	3.2 – 8.9	Kidd et al. 2007	Testicular malformations
Mink frog, *Rana septentrionalis*	fert eggs	Field	2 yr	Intersex gonads (5 – 12 %)	-	3.2 – 8.9	Park and Kidd 2005	
Chinese rare minnow, *Gobiocypris rarus*	7 mo	F,U	28 d	Testis-ova in males	1.0	5.0	Zha et al. 2007	No sperm detectable
Fathead minnow, *Pimephales promelas*	egg	F,U	5 d	Ovarian cavities in males (8%)	-	10	Van Aerle et al. 2002	
Fathead minnow, *Pimephales promelas*	5-10 dph	F,U	5 d	Ovarian cavities in males (38%)	-	10	Van Aerle et al. 2002	
Fathead minnow, *Pimephales promelas*	10-15 dph	F,U	5 d	Ovarian cavities in males (64%)	-	10	Van Aerle et al. 2002	
Fathead minnow, *Pimephales promelas*	15-20 dph	F,U	5 d	Ovarian cavities in males (43%)	-	10	Van Aerle et al. 2002	
Fathead minnow, *Pimephales promelas*	egg	F,U	20 d	Ovarian cavities in males (22%)	-	10	Van Aerle et al. 2002	
Medaka, *Oryzias latipes*	1 d	R,M	LC	Sex inversion and testis-ova	2.9	29	Metcalfe et al. 2001	4 of 4 males with TO
*Three-spined stickleback, *Gasterosteus aculeatus*	Larvae	R,U	42 d	Intersexed gonads	-	50	Hahlbeck et al. 2004a	
Medaka, *Oryzias latipes*	6 mo	F,M	21 d	Testis-ova in males (33%)	33	64	Seki et al. 2002	No histological abnormalities in females
Medaka, *Oryzias latipes*	1 d	R,U	2 mo	All males developed an ovary	10	100	Scholz and Gutzeit 2000	No effect on male fertility
Medaka, *Oryzias latipes*	1 d	R,U	60 d	Intersexed gonads (10%)	10	100	Yamani 2004 and Orn et al 2006	
Guppy, *Poecilia reticulata*	< 7 d	F,M	108 d	Feminization of male reproductive ducts	44	110	Nielsen and Baatrup 2006	
Amphipod, *Hyalella azteca*	fert eggs	R,M	2 x gen	Oocyte-like structures in males	23	320	Vandenbergh et al. 2003	
Leopard frog, *Rana pipiens*	Gosner 25	R,M	162 d	Intersex and altered testicular develepment	414	4,140	Mackenzie et al. 2003	

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Species	Life Stage	Method	Duration	Effect	NOEC (ng/L)	LOEC (ng/L)	Reference	Comments
Wood frog, *Rana sylvatica*	Gosner 25-28	R,M	76 d	Intersex and altered testicular development	-	4,140	Mackenzie et al. 2003	
No Signficiant Effects Observed (NOEC Equals Highest Test Concentration)								
Green frog, *Rana clamitans*	fert eggs	Field	2 yr	Intersexed gonads	3.2 – 8.9	-	Park and Kidd 2005	
Zebrafish, *Danio rerio*	2 dph	R,U	58 d	Testis-ova	10	-	Lin and Janz 2006	
Zebrafish, *Danio rerio*	2 dph	R,U	58 d	Testis-ova	10	-	Hill and Janz 2003	Excessive carrier solvent; high control mortality
Zebrafish, *Danio rerio*	adult	F,U	21 d	Feminization of testes	25	-	Islinger et al. 2003	

*Indicates saltwater species.

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Table A.7. Chronic Reproductive Effects of EE2 on Aquatic Animals (Sexual Behavior).

Species	Life Stage	Method	Duration	Effect	NOEC (ng/L)	LOEC (ng/L)	Reference	Remarks
Significant Effects Observed								
*Sand goby, *Pomatoschistus minutus*	juv	F,U	7 mo	Male nesting behavior	-	6	Robinson et al. 2003	High mortality in solvent controls in first month of exposure
Fathead minnow, *Pimephales promelas*	mature	F,M	27 d	Impaired ability to compete and acquire territory	2.0	8.9	Majewski et al. 2002	
*Three-spined stickleback, *Gasterosterus aculeatus*	mature	R,U	12 d	Time spent near nest and glueing frequency, but effect short-lived	-	10	Brian et al. 2006	
No Signficiant Effects Observed (NOEC Equals Highest Test Concentration)								
Zebrafish, *Danio rerio*	fert egg	F,M	2 x gen	Natural spawning behavior of adult male fish	4.5	-	Nash et al. 2004	Sexually compromised males still actively participated in the spawning act, i.e., chasing females and competing with healthy males
Amphipod, *Gammarus pulex*	3-5 mm	R,M	10 d	Pre-copulatory guarding behavior	3,700,000	-	Watts et al. 2001	Reproductive behavior was only disrupted at high concentrations where it would be unrealistic to attribute effects to and endocrine-mediated process.

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Table A.8. Data on Effects of EE2 on Aquatic Animals (Secondary Sexual Characterstics).

Species	Life Stage	Method	Duration	Effect	Event Association	NOEC (ng/L)	LOEC (ng/L)	Reference	Comments
Significant Effects Observed									
Fathead minnow, *Pimephales promelas*	6-11 mo.	F,M	3 wk	Number of male nuptial tubercles	Activational	-	0.80	Pawlowski et al. 2004	
Fathead minnow, *Pimephales promelas*	40-60 h	F,M	LC	Ovipositor size, nuptial tubercles, banding strength	Organizational	0.32	0.96	Parrott and Blunt 2005	
Fathead minnow, *Pimephales promelas*	156 dph	F,M	LC	Nuptial tubercles, banding strength, dorsal fin dot, dorsal fat pad	Activational	0.32	0.96	Parrott and Blunt 2005	
Fathead minnow, *Pimephales promelas*	fert eggs	F,U	60 dph	Male sex index: nuptial tubercles, dorsal fat pad, dorsal fin dot, banding strength	Organizational	0.32	1.0	Parrot and Wood 2002	Complete femin. at 3.2 ng/L
Fathead minnow), *Pimephales promelas*	<24 hr	F,M	LC	Secondary sex characteristics – not specified	Organizational	0.76	2.8	Länge et al. 2001	50% sex ratio at 0.76 ng/L
Fathead minnow, *Pimephales promelas*	fert eggs	F,U	60 dph	Development and length of ovipositors	Organizational	1.0	3.2	Parrot and Wood 2002	Complete femin. at 3.5 ng/L
Zebrafish, *Danio rerio*	fert egg	F,M	2 x gen	Coloration and bright anal fin markings	Organizational	-	4.5	Nash et al. 2004	
*Sand goby, *Pomatoschistus minutus*	juv	F,U	7 mo	Delayed and inhibited nuptial coloration in males	Activational	-	6.0	Robinson et al. 2003	
Fathead minnow, *Pimephales promelas*	fert eggs	F,U	125 d	Ovipositor size, nuptial tubercles, banding strength	Organizational	-	10	Parrot et al. 2003	
Fathead minnow, *Pimephales promelas*	maturing	F,M	21 d	Number and prominence of nuptial tubercles and dorsal fat pad	Activational	-	11	Filby et al. 2007	
Fathead minnow, *Pimephales promelas*	embryo	F,M	114 d	Number and prominence of nuptial tubercles	Organizational	-	12	Bogers et al. 2006b	
Amphipod, *Hyalella azteca*	fert eggs	R,M	2 x gen	Male second gnathopods	Organizational	-	23	Vandenbergh et al. 2003	No effect >1,000 ng/L
No Signficiant Effects Observed (NOEC Equals Highest Test Concentration)									
Fathead minnow, *Pimephales promelas*	>6 mo.	F,M	3 wk	Relative fat pad weight, number of nuptial tubercles, nuptial tubercle prominence	Activational	1.5	-	Brian et al. 2007	
Medaka, *Oryzias latipes*	4 mo	R,U	14 d	Anal and dorsal fin shape	Organizational	500	-	Thompson 2000; Tilton et al. 2005	

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*Indicates saltwater species.

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Table A.9. Chronic Reproductive Effects of EE2 on Aquatic Animals (Vitellogenin).

Species	Life Stage	Method	Duration	Effect	NOEC (ng/L)	LOEC (ng/L)	Reference	Comments
Significant Effects Observed								
Zebrafish, *Danio rerio*	adult males	F,M	40 d	Increased whole-blood VTG level	-	0.50	Nash et al. 2004	
Fathead minnow, *Pimephales promelas*	6-11 mo	F,M	3 wk	Increased plasma VTG levels	-	0.80	Pawlowski et al. 2004	
Rainbow trout, *Oncorhynchus mykiss*	immature female	F,M	14 d	Increased liver *vtg* mRNA expression and plasma VTG	0.21	1.0	Thomas-Jones et al. 2003	
Zebrafish, *Danio rerio*	20 dph	R,M	40 d	Increased whole body VTG levels	-	1.5	Orn et al. 2003	
Zebrafish ,*Danio rerio*	adult male	R,U	21 d	Increased plasma VTG level	-	1.6	Fenske et al. 2001	
Rainbow trout, *Oncorhynchus mykiss*	Adult male	F,M	3 wk	Increased plasma VTG level	-	1.8	Jobling et al. 1996	
Zebrafish, *Danio rerio*	fert egg	F,M	42 d	Increased vitellogenin level	-	3.0	Fenske et al. 2005	
Fathead minnow, *Pimephales promelas*	-	Field	5 mo	Increased plasma VTG levels	-	3.2 – 8.9	Palace et al. 2002 (also see Kidd et al. 2007)	
Pearl dace, *Margariscus margarita*	-	Field	3 yrs	Increased whole body VTG level	-	3.2 – 8.9	Palace et al. 2006	
Zebrafish, *Danio rerio*	adult male	F,M	8 d	Increased whole-body VTG level	2.2	3.6	Rose et al. 2002	EC10 = 0.92 ng/L
Zebrafish, *Danio rerio*	adult females	F,M	40 d	Increased whole-blood VTG level	0.50	4.5	Nash et al. 2004	
Fathead minnow, *Pimephales promelas*	juv	F,M	21 d	Increased whole-body VTG level	2.0	5.0	Panter et al. 2002	
Fathead minnow, *Pimephales promelas*	8 mo	R,M	48 hrs	Increased liver *vtg* levels	2.5	5.0	Biales et al. 2007	
Ide, *Leucisus idus*	juv	F,M	7 d	Increased plasma VTG levels	-	6.0	Allner et al. 1999	
Zebrafish, *Danio rerio*	fert egg	R,M	4 d	Increased whole body VTG level	2.6	7.8	Bogers et al. 2006a	
Zebrafish, *Danio rerio*	adult females	R,M	21 d	Increased plasma VTG level	4.1	8.5	Van den Belt et al. 2004	
Zebrafish, *Danio rerio*	adult males	F,M	24 d	Increased plasma VTG level	-	9.0	Van den Belt et al. 2002	

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Rainbow trout, *Oncorhynchus mykiss*	11 mo	F,M	2 wk	Increased plasm VTG level	0.87	10	Samuelsson et al. 2006	
*Eelpout, *Zoarces viviparus*	adult female	F,M	3 wk	Increased plasma VTG level	5.0	10	Korsgaard et al. 2002	
Fathead minnow), *Pimephales promelas*	<24 hr	F,M	LC	Increased whole body VTG level	2.8	12	Länge et al. 2001	
Zebrafish, *Danio rerio*	adults	F,M	168 hrs	Increased plasma VTG level	-	14	Hoffmann et al. 2006	
Sturgeon, *Acipenser fulvescens*	1 yr	F,M	25 d	Increased plasma VTG levels	-	14	Palace et al. 2001	
Lake trout, *Salvelinus namaycush*	immature	F,M	21 d	Increased plasma VTG level	-	15	Werner et al. 2003	Excessive carrier solvent
*Baltic flounder, *Platichthys flesus*	adult	F,M	21 d	Increased plasma VTG level in male and female fish	-	15	Allen et al. 1999b	
Medaka, *Oryzias latipes*	6 mo.	F,M	21 d	Increased liver Vtg levels	33	64	Seki et al. 2002	
Rainbow trout, *Oncorhynchus mykiss*	juvenile	R,M	14 d	Increased plasma VTG level	10	100	Verslycke et al. 2002	
*Sheepshead minnow, *Cyprinodon variegatus*	male	F,M	16 d	Increased liver *vtg* mRNA expression	24	110	Folmar et al. 2000	
Rainbow trout, *Oncorhynchus mykiss*	mature male	F,M	61 d	Increased plasma VTG levels	-	140	Skillman et al. 2006	
No Signficiant Effects Observed (NOEC Equals Highest Test Concentration)								
Zebrafish, *Danio rerio*	adult males	F,M	310 dpf F1	No effect on whole-blood VTG level	4.5	-	Nash et al. 2004	
Zebrafish, *Danio rerio*	adult females	F,M	310 dpf F1	No effect on whole-blood VTG level	4.5	-	Nash et al. 2004	

*Indicates saltwater species.

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Table A.10. Chronic Effects of EE2 on Aquatic Animals (Other Relevant Endpoints).

Species	Life Stage	Method	Duration	Effect	Concentration (ng/L)	Reference	Remarks
Significant Effects Observed							
Zebrafish , *Danio rerio*	17-20 dpf	R,U	3 d	Enhanced effect on CYP19A2 gene expression	0.30	Kazeto et al. 2004	Excessive carrier solvent
Zebrafish, *Danio rerio*	2 dph	R,U	58 d	Suppression of gametogenesis for males (no testes discernable) and females	1.0	Weber et al 2003	Excessive carrier solvent
Chinese rare minnow, *Gobiocypris rarus*	7 mo	F,U	28 d	Increased GSI and renal somatic index (RSI) in males	1.0	Zha et al. 2007	
Fathead minnow, *Pimephales promelas*	40-60 h	F,M	LC	Reduced GSI in females	3.5	Parrott and Blunt 2005	
Atlantic salmon, *Salmo salar*	immature	S,U	7 d	Increased AchE and GST activities and lactate content after 3 days, but no effect at 7 days	5.0	Greco et al. 2007	
Chinese rare minnow, *Gobiocypris rarus*	7 mo	F,U	28 d	Reduced GSI in females	5.0	Zha et al. 2007	
Chinese rare minnow, *Gobiocypris rarus*	7 mo	F,U	28 d	Increased RSI in females	5.0	Zha et al. 2007	
Medaka, *Oryzias latipes*	4 mo	R,U	14 d	Increased male and female plasma E2 levels	5.0	Thomposn 2000; Tilton et al. 2005	
Fathead minnow, *Pimephales promelas*	6-11 mo	F,M	3 wk	Reduction on male GSI	7.5	Pawlowski et al. 2004	
Zebrafish, *Danio rerio*	Adult female	R,M	21 d	Reduced female ovarian somatic index	8.5	Van den Belt et al. 2004	
Rainbow trout, *Oncorhynchus mykiss*	11 mo	F,M	2 wk	Higher hepatosomatic index (HSI)	10	Samuelsson et al. 2006	
Fathead minnow, *Pimephales promelas*	fert eggs	F,U	125 d	Increased liver somatic index	10	Parrot et al. 2003	
Medaka, *Oryzias latipes*	1 d	R,U	4 mo	In both males and females, significantly increased number of necrotic hepatocytes and kidney tubule cells	10	Weber et al. 2004	
*Baltic flounder, *Platichthys flesus*	adult	F,M	21 d	Increased HSI in males	15	Allen et al. 1999	
Zebrafish, *Danio rerio*	adult male	S,M	21 d	Increased levels of cyp19a2 mRNA (aromatase)	21	Kallivretaki et al. 2006	
Chinese rare minnow, *Gobiocypris rarus*	7 mo	F,U	28 d	Increased HSI in males	25	Zha et al. 2007	

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Species	Life Stage	Method	Duration	Effect	Concentration (ng/L)	Reference	Remarks
Chinese rare minnow, *Gobiocypris rarus*	7 mo	F,U	28 d	Ovary degeneration in females	25	Zha et al. 2007	
Zebrafish, Danio rerio	adult male	F,M	7 d	Decreased testrosterone and 11-ketotestosterone levels	26	Andersen et al. 2006	
Atlantic salmon, *Salmo salar*	immature	S,U	72 hr	Induced expression of brain P450 Aromatase	50	Lyssimachou et al. 2006	
Sturgeon, *Acipenser fulvescens*	1 yr	F,M	25 d	Increased plasma Vit E, A1 and A2; Decreased Vit E and A in kidney	60	Palace et al. 2001	
*Sheepshead minnow, *Cyprinodon variegatus*	juv	F,M	PLC	Increased pathological condition of kidneys	120	Zillioux et al. 2001	Fish survived to reproduction
Rainbow trout, *Oncorhynchus mykiss*	mature male	F,M	3 wk	Changed gene expression profile	130	Hook et al. 2007	
Zebrafish , Danio rerio	18-21 d	R,U	72 hr	Stimulated expression of Cytochrome P450 aromatase (Aro-B)	300	Le Page et al. 2006	
Medaka, *Oryzias latipes*	mature	R,U	14 d	Induced ER protein and aromatase activity	500	Contractor et al. 2004	
Medaka, *Oryzias latipes*	adult	R,U	14 d	Increased hepatic estrogen receptor (ER)	500	Thompson 2000	
Medaka, *Oryzias latipes*	4 mo.	R,U	14 d	Decreased female and male GSI	500	Thompson 2000; Tilton et al. 2005	
African clawed frog, *Xenopus laevis*	adult	R,U	4 wk	Reduced Leutinizing hormone B mRNA expression	3,000	Urbatzka et al. 2006	
African clawed frog, Xenopus laevis	adult	R,U	4 wk	Reduced testosterone levels in both sexes	3,000	Urbatzka et al. 2007	
African clawed frog, Xenopus laevis	adult	R,U	4 wk	Reduced E2 level in females	3,000	Urbatzka et al. 2007	
Midge, *Chironomus riparius*	4th instar	S,U	24 h	Increased expression of heat shock proteins	8,000	Lee et al. 2006	
Medaka, *Oryzias latipes*	mature male	R,U	6 d	Increased mRNA expression of liver choriogenin L	10,000	Lee et al. 2002b	
Medaka, *Oryzias latipes*	mature male	R,U	6 d	Increased mRNA expression of liver choriogenin H levels	20,000	Lee et al. 2002b	
Medaka, *Oryzias latipes*	mature male	R,U	6 d	Increased mRNA expression of liver choriogenin H levels	20,000	Lee et al. 2002a	
Medaka, *Oryzias latipes*	juv	R,U	6 d	Increased mRNA expression of whole body Choriogenic H	50,000	Lee et al. 2002a	

No Signficiant Effects Observed (NOEC Equals Highest Test Concentration)

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Species	Life Stage	Method	Duration	Effect	Concentration (ng/L)	Reference	Remarks
*Sand goby, *Pomatoschistus minutus*	juv	F,U	7 mo	No effect on GSI in males or females	6.0	Robinson et al. 2003	
Rainbow trout, *Oncorhynchus mykiss*	juvenile	R,M	14 d	No effect on GSI or HSI	100	Verslycke et al. 2002	
African clawed frog, *Xenopus laevis*	adult	R,U	4 wk	No effect on Gonadotropin Releasing Hormone mRNA expression	3,000	Urbatzka et al. 2006	

*Indicates saltwater species.

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Exhibit 3

Analysis and removal of emerging contaminants in wastewater and drinking water

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Abstract

The occurrence of trace organic contaminants in wastewaters, their behaviour during wastewater treatment and drinking water production are the key issues in relation to the reuse of water resources. Elimination of different classes of emerging contaminants, such as surfactant degradates, pharmaceuticals and polar pesticides in wastewater treatment plants (WWTP) was found to be rather low and consequently sewage effluents are one of the main sources of these compounds and their recalcitrant metabolites.

This paper reviews the state-of-the-art in the analysis of several groups of emerging contaminants (acidic pharmaceuticals, antibacterial agents, acidic pesticides and surfactant metabolites) in wastewaters. Their elimination in WWTP applying conventional activated sludge treatment and advanced treatment processes, such as membrane bioreactors (MBR) and advanced oxidation (AOP), as well as the elimination during drinking water production are discussed.

Keywords

Acidic pharmaceuticals; Acidic pesticides; Advanced treatment; Emerging contaminants; Surfactant degradates, Wastewater treatment

1. Introduction

Until the beginning of the 1990' non-polar hazardous compounds, i. e. persistent organic pollutants (POP) and heavy metals, were in the focus of interest and awareness as priority pollutants, and consequently were part of intensive monitoring programs. Today, these compounds are less relevant for the industrialized countries since a drastic reduction of emission has been achieved due to the adoption of appropriate measures and elimination of the dominant pollution sources.

However, the emission of so-called "emerging" or "new" unregulated contaminants has emerged as an environmental problem and there is a widespread consensus that this kind of contamination may require legislative intervention. This group is mainly composed of products used in large quantities in everyday life, such as human and veterinary pharmaceuticals, personal care products, surfactants and surfactants' residues, plasticizers and different industrial additives. The characteristic of these contaminants is that they do not need to be persistent in the environment to cause negative effect since their high transformation/removal rates can be compensated by their continuous introduction into environment. One of the main sources of emerging contaminants are untreated urban wastewaters and wastewater treatment plant (WWTP) effluents. (Fig. 1). Most current WWTP are not designed to treat this type of substances and the high portion of emerging compounds and their metabolites can escape elimination in the WWTP and enter the aquatic environment via sewage effluents.

The partial or complete closing of water cycles is an essential part of sustainable water resources management and the increasing scarcity of pristine waters for drinking water supply and increasing consume of water by industry and agriculture should be countered by the efficient and rational utilisation of resources. One of the options is

increasing reuse of effluents for various purposes, especially in industrial and agro/food production activities. However, due to high cost of end-of-pipe approach (drinking water treatment) the future of indirect potable reuse requires an efficient treatment of wastewaters prior to their discharge. Thus, the occurrence of trace organic contaminants in wastewaters, their behaviour during wastewater treatment and drinking water production are the key issues that require further study.

Many believe that of all emerging contaminants, antibiotics are the biggest concern, since their emission in the environment can result in an increased occurrence of resistant bacteria in the environment [1]. However, other emerging compounds, especially polar one, such as acidic pharmaceuticals, acidic pesticides and acidic metabolites of non-ionic surfactants also deserve particular attention. Due to their physico-chemical properties (high water solubility and often poor degradability) they are able to penetrate through all natural filtration steps and man-made treatments, thus presenting a potential risk for drinking water supply [2,3].

Different classes of emerging contaminants, mainly surfactant degradates, pharmaceuticals and personal care products (PPCP) and polar pesticides were found to have rather low elimination rates and have been detected in WWTP effluents and in the receiving surface waters. However, for most of emerging contaminants, occurrence, risk assessment and ecotoxicological data are not available and it is difficult to predict their fate in the aquatic environment. Partially, the reason for this is a lack of analytical methods for their determination at trace concentrations. Analysis of emerging contaminants is a real analytical challenge, not only because of the diversity of chemical properties of these compounds, but also because of generally low concentrations (usually part per billion or part per trillion levels) and the complexity of matrices.

This paper reviews the state-of-the-art in the analysis of several groups of emerging contaminants (acidic pharmaceuticals, antibacterial agents, acidic pesticides and surfactant metabolites) in wastewaters. Various aspects of current LC-MS-(MS) and GC-MS methodology, including sample preparation, are discussed.

It also gives a survey of their elimination in WWTP by activated sludge treatment (AST) and applying advanced treatment processes, such as membrane bioreactors (MBR) and advanced oxidation (AOP). Additionally, the elimination in treatment processes at drinking water treatment plants is discussed.

2. Analysis of emerging contaminants in wastewaters

One of the major limitations in the analysis of emerging contaminants remains to be the lack of analytical methods for quantification of low concentrations. The prerequisite for proper risk assessment and monitoring of waste, surface and drinking water quality is the availability of a multiresidual analytical method that permits measurement at the low (or even below) ng/L level. However, the fact that these compounds are not on the regulatory lists as environmental pollutants resulted in comparatively little attention received. Consequently, analytical methodology for different groups of emerging contaminants is evolving and the number of methods described in the literature for the determination of emerging contaminants has grown considerably. Still, the analysis of this group of contaminants requires further improvements in terms of sensitivity and selectivity, especially for very complex matrices, such as wastewater.

2.1. Acidic pharmaceuticals

Different analytical methods, mainly based on LC-MS and GC-MS, repectively in combination with either polymer or C_{18}-based solid phase extraction (SPE), are being developed for the analysis of pharmaceutical compounds. However, most methods are tailored for neutral compounds (e.g. antibiotics) and less complex matrices (surface and groundwater), while only a limited number of paper describes procedures applicable to the analysis of polar drugs in wastewater samples. A survey of analytical methods for the quantification of regularly used polar pharmaceuticals in wastewater matrices is given in Table 1.

A typical analytical method includes the use of octadecylsilica, polymeric, or hydrophilic-lipophilic balanced (HBL) supports for off-line SPE of water samples, with either disks or, most frequently, cartridges at low pH (typically pH=2).

Separation technique used includes both GC and LC, while for detection, MS has been the technique most widely employed. Due to low volatility of polar pharmaceuticals GC-MS analysis requires additional derivatization step, which makes the sample preparation laborious and time consuming, and also increases the possibility of contamination and errors. Moreover, some compounds are thermolabile and decompose during GC analysis (e.g. carbamazepine forms iminostilben as degradation product) [4].

Consequently, LC-MS and LC-MS-MS are increasingly used. Reviewing principal analytical methods employed in the analysis of pharmaceuticals in aqueous environmental samples Ternes [4] indicated LC-MS-MS as the technique of choice to assay polar pharmaceuticals and their metabolites, however pointed out the difficulty in the enrichment step, as well as the low resolution and the suppression of signals in the electrospray (ESI) interface due to matrix impurities. Farré et al. [5] have compared LC-(ESI)-MS and GC-

MS (after a derivatization with BF_3-MeOH) for the monitoring of some acidic and very polar analgesics (salicylic acid, ketoprofen, naproxen, diclofenac, ibuprofen and gemfibrozil) in surface waters and wastewater samples. Results showed a good correlation between methods expect for the gemfibrozil which derivatization was not completely achieved in some samples.

In general, the limits of detection (LODs) achieved with the LC-MS-(MS) methods were slightly higher than those obtained with the GC-MS methods (see Table 1), however, LC-MS methodology showed advantages in terms of versatility and less complicated sample preparation (no derivatization needed).

Table 2 summarizes the quantitation and qualifier ions used by the various authors for the determination of polar drugs in wastewaters using the selected ion monitoring (SIM) or the multiple reaction monitoring (MRM) mode. The use of triple-quadropole mass spectrometers in LC analysis has substantially increased the selectivity and sensitivity of the determination, resulting in LODs better than those achieved by use of single-quadropole LC-MS. Acidic drugs were usually detected using an ESI interface under negative ionization conditions and deprotonated molecules where chosen as precursor ions. Typical fragmentation pattern obtained with LC-MS-MS showed a loss of CO_2 (or loss of the acidic moiety), with a limited number of other products. For example, for diclofenac, ibuprofen and ketoprofen the product ions generated by expulsion of CO_2 were the only fragment ions formed.

2.2. Acidic pesticides

Chlorinated phenoxy acid herbicides account for the majority of pesticides used worldwide and their presence in environmental waters is well documented. However, their

behaviour during wastewater treatment was rarely studied. This group of herbicides is characterized by high polarity and thermal lability. For these reasons LC is generally more suitable for their analysis, as the sample pretreatment does not require a time-consuming derivatization step. However, the methods used to determine chlorinated phenoxy acid herbicides are still dominated by GC either with electron capture detector (ECD) or MS detection. The main disadvantage of GC analysis is that requires prior derivatization step, usually using highly toxic and carcinogenic diazomethane or, less frequently used, acid anhydrides, benzyl halides and alkylchloroformates. The injection-port derivatization with an ion-pair reagent has been successfully applied [6], as well as, in-situ derivatization prior to solid-phase microextraction (SPME) [7].

Alternative methods based on LC-MS have been proposed, using an ESI interface, which is well suited to the determination of easily ionized chlorinated phenoxy acids. Using LC-MS-(MS), phenoxy acid herbicides are detected under negative ionization conditions typically yielding $[M–H]^-$ ion and one abundant fragment formed by the loss of acidic moiety [8,9].

Recently, in-tube SPME followed by LC-MS was applied for the determination of six chlorinated phenoxy acid herbicides [10]. However, method was applied to river water achieving LODs ranging from 5 to 30 ng/l, while more complex wastewater matrix was not tested.

2.3. Antiseptics

Several methods have been proposed for the determination of triclosan (5-chloro-2-[2,4-dichlorophenoxy] phenol), which is used as an antiseptic agent in a vast array of

personal care (e.g. toothpaste, acne cream, deodorant, shampoo, toilet soap) and consumer products (children's toys, footwear, kitchen cutting boards).

Methods based on diazomethane derivatization and capillary GC-ECD was applied for their quantification in the wastewater of a slaughterhouse [11], using silica clean up without derivatization and analysis by GC-MS [12] and SPE of acidified wastewater water samples and SFE for lyophilized sludge, respectively followed by derivatization and GC-HRMS were recently developed [13].

Recently, a method based on LC-MS was also proposed, achieving a limit of detection of 0.35 μg/L in spiked urban wastewater [14].

2.4. Alkylphenolic compounds

The trace analysis of alkylphenol ethoxylates (APEOs) and their acidic metabolites by LC-MS or LC-MS-MS using atmospheric pressure ionization (API) has been recently reviewed by Petrovic *et al*. [15,16] and the performances of two ionization methods, APCI and ESI, in terms of selectivity and sensitivity toward oligomeric mixtures of APEOs has been discussed. Generally, ESI interface is more often used for the analysis of alkylphenolic compounds due to the higher sensitivity, especially for alkylphenols and carboxylated compounds.

Alkylphenoxy carboxylates (APEC) were detected, in both, the NI and PI mode. In the NI mode, using ESI, APECs give two types of ions, one corresponding to the deprotonated molecule $[M-H]^-$ (*m/z* 277, 321, 263 and 307 corresponding to nonylphenol carboxylate (NPE_1C), nonylphenol ethoxycarboxylate (NPE_2C), octylphenol carboxylate (OPE_1C), and octylphenol ethoxycarboxylate (OPE_2C), respectively) and the other corresponding to deprotonated alkylphenols [17]. The relative abundance of these two ions

depends on the extraction voltage. In the presence of ammonium acetate and using an APCI under PI conditions NPE_1C gave $[M+NH_4]^+$ ions at *m/z* 296, while NPE_2C, gave $[M+NH_4]^+$ ion at *m/z* 340 [18].

LC-ESI-MS was also applied for the analysis of the dicarboxylated breakdown products (carboxylated alkylphenoxy carboxylates; CAPECs) in wastewaters [19,20]. However, the identification of these compounds using LC-MS, under conditions giving solely molecular ions, is difficult since CA_nPE_mCs have the same molecular mass as APECs having one ethoxy unit less and a shorter alkyl chain ($A_{n-1}PE_{m-1}C$). Moreover, since some compounds partially co-elute, the unequivocal assignment of the individual fragments can be accomplished only using LC-MS-MS. Typical fragmentation pattern obtained with LC-ESI-MS-MS showed the formation of the carboxy-alkylphenoxy fragment, with an additionally lost CO_2, or an acetic acid group, in the case of $CA_5PE_{1-2}C$ leading to the fragments of *m/z* 149 and 133 [19].

MS-MS spectra of APECs [19,21,22] shows an intense signal at *m/z* 219 (for NPECs) and *m/z* 205 (for OPECs) that is produced after the loss of the carboxylated (ethoxy) moiety, while sequential fragmentation of the alkyl chain resulted in ions *m/z* 133 and 147.

To overcome the problem with the low volatility of acidic alkylphenolic compounds different off-line and on-line derivatization protocols, respectively have been developed. Off-line derivatization to corresponding triemethylsilyl ethers, methyl ethers, acetyl esters, pentafluorobenzoyl, or heptafluorobutyl esters, respectively was applied as a common approach in GC-MS analysis. On-line direct GC injection-port derivatization using ion-pair reagents (tetraalkylammonium salts), has been also reported [23]. The most significant ions in GC-(EI)-MS of methylated NPECs were fragments produced by rupture of the benzylic bond in the branched nonyl side-chain [23,24,25]. GC-CI-MS spectra of

the NPECs with isobutane as reagent gas showed characteristic hydride ion-abstracted fragment ions shifted by 1 Da from those in the corresponding EI mass spectra [22]. Using ammonia as reagent gas intense ammonia-molecular ion adducts of the methyl esters, with little, or no secondary fragmentation were reported for the detection of NPECs [26]. Ions selected were as follows: *m/z* 246, 310, 354 and 398 for NPE_1C, NPE_2C, NPE_3C and NPE_4C, respectively.

3. Elimination by activated sludge treatment (AST)

The present state-of-the-art of wastewater treatment involves treatment by the activated sludge treatment (AST) process proceeded with conventional physico-chemical pre-treatment steps. Table 3. summarizes data on the elimination of emerging contaminants in WWTP.

3.1. Pharmaceuticals and personal care products

Daughton and Ternes [1] reviewed the occurrence of over 50 individual PPCPs, or metabolites from more than 10 broad classes of therapeutic agents, or personal care products in environmental samples, mainly in WWTP effluents, surface, and ground waters and much less frequently in drinking waters. Acidic drugs are the major group of PPCPs detected in municipal WWTP and among them bezafibrate, naproxen, and ibuprofen were the most abundant (concentrations up to 4.6 μg/l were detected in German municipal WWTPs). Tixier et al. [27] determined that carbamezapine presented the highest daily load

from the WWTP into Lake Greifensee (Switzerland), followed by diclofenac, and naproxen. Their elimination during passage through a municipal sewage treatment in most cases was found to be quite low (see table 3), ranging from 35 to 90% and some compounds, like carbamazepine, exhibit extremely low removal (only 7%) [28]. Consequently, through sewage effluents they can enter receiving surface waters and thus become a potential risk in the production of drinking water. For example, the clofibric acid, a metabolite of three lipid regulating agents (clofibrate, etofibrate and fenofibrate) has been identified in river and ground water and even in drinking water at concentrations ranging up to 165 ng/l [29,30].

3.2. Acidic Pesticides

Chlorinated phenoxyacids are a kind of compounds widely used in agriculture. This group includes, for example, mecoprop (MCPP), MCPA, 2,4-D, 2,4-DP 2,4,5-T, 2,4-DB. Monitoring of these herbicides is important in surface water because of their potential toxicity towards animals and humans [31], however, these compounds are not only used for agricultural purposes, but also as herbicides on lawns, algicides in paints and coatings or as roof protection agents in flat roof sealings. So, residues of these substances are introduced into the aquatic system through different pathways. For example, in the catchment area of Lake Greifensee (Switzerland) 65% of the mecoprop originated from WWTPs and the remaining 35% from diffuse sources [32].

Degradation of acidic pesticides under laboratory conditions is well studied, but there are only few publications dealing with their behaviour in real wastewater treatment processes. Generally, activated sludge treatment was found to be ineffective in removing chlorinated phenoxy acid herbicides from settled sewage. However, under laboratory

conditions mecoprop proved to be biodegradable (nearly 100%), however it required long adaptation time (lag-phase) of activated sludge [33]. In real wastewater treatment processes this presents a major difficulty since, like the majority of herbicides, mecoprop is applied only during a short growth period of plants, which means that during this period WWTPs, that contains a non-adapted activated sludge, receive shock-loads of herbicides and consequently these substances are not eliminated.

A long acclimation period (about 4 months) was also observed in a bench-scale study using sequencing batch reactors before 2,4-D biodegradation was established [34]. Afterwards, at steady-state operation, all reactors achieved practically complete removal (>99%) of 2,4-D.

3.3. Alkylphenolic surfactants

Although their environmental acceptability is strongly disputed APEOs are still among the most widely used non-ionic surfactants. Currently, under optimised conditions, more than 90-95% of surfactants are eliminated by conventional biological wastewater treatment (normally activated sludge treatment). Even if such high elimination rates are achieved, the principal problem is the formation of recalcitrant metabolites out of the parent surfactants. The widespread occurrence of APEO-derived compounds in treated wastewaters and the following disposal of effluents into aquatic system raise concerns about their impact on the environment. Studies have shown that their neutral (alkylphenols and short ethoxy chain ethoxylates) and acidic recalcitrant metabolites (APEC) possess the ability to mimic natural hormones by interacting with the estrogen receptor.

It was estimated that approximately 60 to 65% of all nonylphenolic compounds introduced to WWTP are discharged into the environment; 19% in the form of

carboxylated derivatives, 11% in the form of lipophilic NP_1EO and NP_2EO, 25% in the form of NP and 8% as untransformed NPEOs [35].

However, contrary to the general believing that NPECs are the refractory metabolites, Di Corcia et al. [36] determined that CAPECs are the dominant products of the NPEO biotransformation. By averaging data relative to the treated effluents of five major activated sludge WWTP of Rome (Italy) over 4 months, relative abundances of NPEO (n_{EO}=1 and 2), NPECs and CAPECs were found to be respectively 10±2%, 24±5% and 66±7%.

The average concentrations of acidic metabolites, NPECs and CAPECs are at low μg/L range, however high values, up to several tens of hundreds of μg/L, are detected in effluents of WWTP receiving industrial wastewaters, especially from tannery, textile, pulp and paper industry [37].

4. Elimination by advance wastewater treatment processes

Although, adopted as the best available technology; biological treatment permits only partial removal of a wide range of emerging contaminants, especially polar ones, which are discharge into the final effluent. Thus, it has become evident that application of more enhanced technologies may be crucial for the fulfilment of the requirements of an indirect potable reuse of municipal and industrial wastewater. In recent years, new technologies are being studied, not only for wastewater treatment but also for drinking water production. Among them membrane treatment, using both biological (membrane bioreactors) and non-biological processes (reversed osmosis, ultrafiltration, nanofiltration),

and advanced oxidation processes (AOP) are most frequently considered as treatments that may be appropriate to remove trace concentrations of polar emerging contaminants.

4.1. Membrane processes

Membrane bioreactor (MBR) technology is considered as the most promising development in microbiological wastewater treatment. Now, when economic reasons do no longer limit the application of MBR to industrial and municipal wastewater (WW) treatment [38] and that new requirements are being set for the treatment of WW, MBR treatment may become a key technique in all future scenarios that consider the direct or indirect reuse of wastewaters. This is due to two characteristics of MBRs, (a) the low sludge load in terms of BOD that can be expected to force bacteria to mineralise also poorly degradable organic compounds and (b) the high sludge age that gives the bacteria time to adapt to these substances [39,40].

However, although many articles have reported the application of MBR for the treatment of urban and industrial wastewaters, up to our knowledge there are only few papers reporting on the behaviour of emerging contaminants during the MBR treatment, and all of them dealt with nonylphenolic compounds.

Using the MBR unit that comprises of three bioreactors and an external ultrafiltration unit followed by GAC adsorption, Witgens et al. [41] reported on the removal of more than 90% of NP in wastewater from a dumpsite leachate plant. Laboratory set of nanofiltration membranes resulted in retention of more than 70% of NP and this process was regarded as an alternative option for the final treatment of MBR effluent.

Li et al. [42] used GC-MS and LC-MS-MS to assess the elimination efficiency in membrane-assisted biological WWTP. The results showed that compared to conventional WWTP membrane assisted biological treatment with biomass concentrations of about 20g/l could only improve elimination efficiency of NPEOs (and other ionic and non-ionic surfactants), but could not stop entirely the discharge with the permeates.

4.2. Treatment by advanced oxidation processes (AOP)

The AOP processes, using the combination of ozone with other oxidant agents (UV radiation, hydrogen peroxide, TiO_2) have been studied to enhance the degradation of polar pharmaceuticals [43,44,45] and NPEOs metabolites [46]. Ternes et al. [45] used a pilot plant for ozonation and UV disinfection of effluents form a German municipal WWTP containing antibiotics, betablockers, antiphlogistics, lipid regulator metabolites, musk fragrances and iodinated X-ray contrast media. By applying 10-15 mg/l ozone (contact time 18 min) all the pharmaceuticals investigated were no longer detected. Exception was the ionic iodinated X-ray contrast compounds that exhibited removal efficiencies of not higher than 14%.

In another study [44] the ozonation has been demonstrated to be a suitable tool for carbamazepine abatment even at the process conditions usually adopted in drinking water facilities. However, in spite of good primary elimination, a low degree of mineralization was observed and total carbon balance results lacking even for prolonged ozonation thus indicative the presence of some non-identified degradation products.

However, the degradation efficiency of an AOP is limited by the radical scavenging capacity of the matrix of the treated water. Thus, for a sufficient degradation of the

pharmaceuticals (>90%) from wastewater the ozone concentration has to be equal to the dissolved organic carbon (DOC) value [43], which means that economic considerations have to prove the feasibility of the process for wastewater treatment.

Recently, using a lab-scale reactor, Ike et al. [46] determined that the effectiveness of ozone treatment in the degradation of NPEO metabolites follows the order: NPE_1C>>NP>NP_1EO. Acidic metabolites were completely degraded within 4-6 min (initial concentration was between 0.4 and 1.0 mg/l), NP concentration reduced 75-80% in 6 min, while only 25 to 50% of NP_1EO was eliminated in the same time.

5. Elimination by treatment processes at drinking water treatment plants

The occurrence of organic micro-contaminants in raw water and their removal in the course of drinking water production and possible formation of disinfection by-products are key issues in relation to the quality of drinking water supplies. Although, substances covered by this review are currently not regulated in drinking water, precautionary principles should be employed, and the removal of all organic micro-contaminants should be as high as possible. However, several studies showed that the removal of polar emerging contaminants during the drinking water treatment is not complete.

The elimination of selected pharmaceuticals (clofibric acid, diclofenac, carbamezapine, bezafibrate) during drinking water treatment processes was investigated at lab and pilot scale and in real waterworks in Germany [47]. Sand filtration under aerobic and anoxic conditions, as well as flocculation using iron(III)chloride exhibited no significant elimination of the target pharmaceuticals, while ozonation was quite effective in

eliminating these polar compounds. Diclofenac and carbamezapine were reduced by more than 90%, bezafibrate was eliminated by 50%, while clofibric acid was stable even at high ozone doze. Filtration with granular activated carbon (GAC), under waterworks conditions was very effective in removing pharmaceuticals. Exception was clofibric acid which was less prone to adsorption.

The behaviour of polar alkylphenolic compounds during processing of contaminated water in waterworks and their possible occurrence in treated water has been was rarely the scope of interest and there are hardly any data available for drinking water. The elimination of neutral and acidic nonylphenolic compounds and their brominated and chlorinated derivatives, during drinking water treatment process at the waterworks that supply drinking water to city of Barcelona (Spain) was investigated utilizing a highly sensitive LC-MS-MS method [48]. The concentration of total nonylphenolic compounds: NPEC (n_{EO}=0-1), NPEO (n_{EO}=1-2) and NP; in raw water (the Llobregat river) entering waterworks ranged from 8.3 to 21.6 μg/L, with NPE_2C being the most abundant compound. Prechlorination reduced the concentration of short-ethoxy chain NPECs and NPEOs by about 25-35%, and of NP by almost 90%. However, this reduction of concentrations was partially due to their transformation to halogenated derivatives. After prechlorination halogenated nonylphenolic compounds represented approximately 13% of the total metabolite pool, of which 97% were in the form of brominated acidic metabolites. The efficiency of further treatment steps to eliminate nonylphenolic compounds (calculated for the sum of all short ethoxy chain metabolites including halogenated derivatives) was as follows: settling and flocculation followed by rapid sand filtration (7.3%), ozonation (86.3 %), GAC filtration (72.7%) and final disinfection with chlorine (42.8%), resulting in overall elimination ranging from 96.2 to 99.1% (mean 97.9% for four sampling dates) as shown in Fig. 2.

6. Conclusions

The application of advanced LC-MS and GC-MS technologies to environmental analysis has allowed the determination of a broader range of compounds and thus permitted more comprehensive assessment of environmental contaminants. Among the various compounds considered as emerging pollutants, acidic pharmaceuticals, surfactant degradates and acidic pesticides are of particular concern, both because of their ubiquity in the aquatic environment and potential impacts.

Elimination of these emerging contaminants during wastewater and drinking water treatment is not satisfactory; and an improved treatment and strict control of the treatment process have to be employed so that the removal of these micro-contaminants is as high as possible. Thus, in view of possible reuse of WWTP effluents, more research is needed to evaluate their behaviour and fate in the aquatic environment. Moreover, disinfection processes applied (either chlorination or ozonation) potentially shift the assessment of the risk of human consumption of the parent compound to its degradation products, which requires development of generic analytical protocols that will permit simultaneous determination of parent compounds and their metabolites.

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References

(after tables and figures)

Figure captions

Fig. 1. Components of a (partially) closed water cycle with indirect potable reuse

Fig. 2. Fate of nonylphenolic compounds during drinking water production. A) Total concentration of nonylphenolic compounds and their elimination during different treatment steps at waterworks Sant Joan Despì (Barcelona, Spain); B) Average composition (calculated on a molar basis) of nonylphenolic compounds in raw water; C) Average composition (calculated on a molar basis) of nonylphenolic compounds in prechlorinated water

Table 1. Methods for the analysis of acidic pharmaceuticals in wastewaters

Compounds	Extraction	Derivatization	Chromatographic method	Detection	LOD (ng/L)	Reference
Bezafibrate, diclofenac, ibuprofen, gemfibrozil, carbamezapine	Sequential SPE (C18 + polymeric sorbent)	-	LC	MS	2	49
Salicylic acid, ibuprofen, ketoprofen, naproxen, bezafibrate, diclofenac	SPE (polymeric sorbent)	-	LC	MS	5-56	5
Bezafibrate, clofibric acid, diclofenac, fenoprofen, gemfibrozil, ibuprofen, inomethacin, ketoprofen, naproxen	SPE (C18)	-	LC	MS-MS	5-20	50
Bezafibrate, clofibric acid, ibuprofen	SPE (MCX or polymeric sorbent)	-	LC	MS-MS	0.016-2.18	51
Ibuprofen, clofibric acid, ketoprofen, naproxen, diclofenac	SPE (HLB)	diazomethane	GC	MS	0.3-4.5	52
Clofibric acid, diclofenac, ibuprofen, phenazone, propyphenazone	SPE (C18)	Pentaflorobenzyl bromide	GC	MS	0.6-20	53
Clofibric acid, naproxen, ibuprofen	SPE (polar Empore disk)	BSTFA (bis (trimethylsilyl)-triflouroacetamide	GC	MS	0.4-2.6	54
Ibuprofen, naproxen, ketoprofen, tolfenamic acid, diclofenac, meclofenamic acid	SPE (HLB)	MTBSTFA (N-methyl-N-(tert-butyldimethylsilyl) trifluoroacetamide	GC	MS	20	55

Table 2. Quantitation and diagnostic ions (*m/z*) used for the LC-MS and GC-MS, and base peaks of precursor and product ions used for LC-MS-MS analysis of acidic pharmaceuticals in wastewaters. Data compiled from references listed in Table 1.

Compound	Analytical method	Ionization mode	MS	MS-MS		
			SIM ions	Precursor (*m/z*)	Product 1 (*m/z*)	Product 2 (*m/z*)
Ibuprofen	LC-MS	NI	205, 159			
	LC-MS-MS	NI		205 $[M–H]^–$	161 $[M–H–CO_2]^–$	-
	GC-MS	Positive EI	177, 220[a]			
			161, 343, 386[b]			
			263, 278, 234[c]			
Diclofenac	LC-MS	NI	294, 250, 232			
	LC-MS-MS	NI		294 $[M–H]^–$	250 $[M–H–CO_2]^–$	-
	GC-MS	Positive EI	214, 309[a]			
			214, 216, 475[b]			
			352/354/356[d]			
Clofibric acid	LC-MS	NI				
	LC-MS-MS	NI		213 $[M–H]^–$	127 $[C_6H_4ClO]^–$	85 $[C_4H_5O_2]^–$
	GC-MS	Positive EI	128, 228[a]			
			128, 130, 394[b]			
			128, 143, 286[c]			
Benzafibrate	LC-MS	NI	360, 274			
	LC-MS-MS	NI		360 $[M–H]^–$	274 $[M-H-C_4H_6O_2]^–$	154 $[M-H-C_{12}H_{14}O_3]^–$
	GC-MS	Positive EI	128, 228[a]			
			128, 130, 394[b]			
Gemfibrozil	LC-MS	NI	249, 121			
	LC-MS-MS	NI		249 $[M–H]^–$	121 $[M-H-C_7H_{12}O_2]^–$	
Ketoprofen	LC-MS	NI	253, 209, 197			
	LC-MS-MS	NI		253 $[M–H]^–$	209 $[M-H-CO_2]^–$	
	GC-MS	Positive EI	209, 268[a]			
			311[d]			
Naproxen	LC-MS	NI	229, 185, 173, 170			
	LC-MS-MS	NI		229 $[M–H]^–$	185 $[M-H-CO_2]^–$	170 $[M-H-C_2H_3O_2]^–$
	GC-MS	Positive EI	185, 244[a]			
			243, 302, 185[c]			
			287[d]			

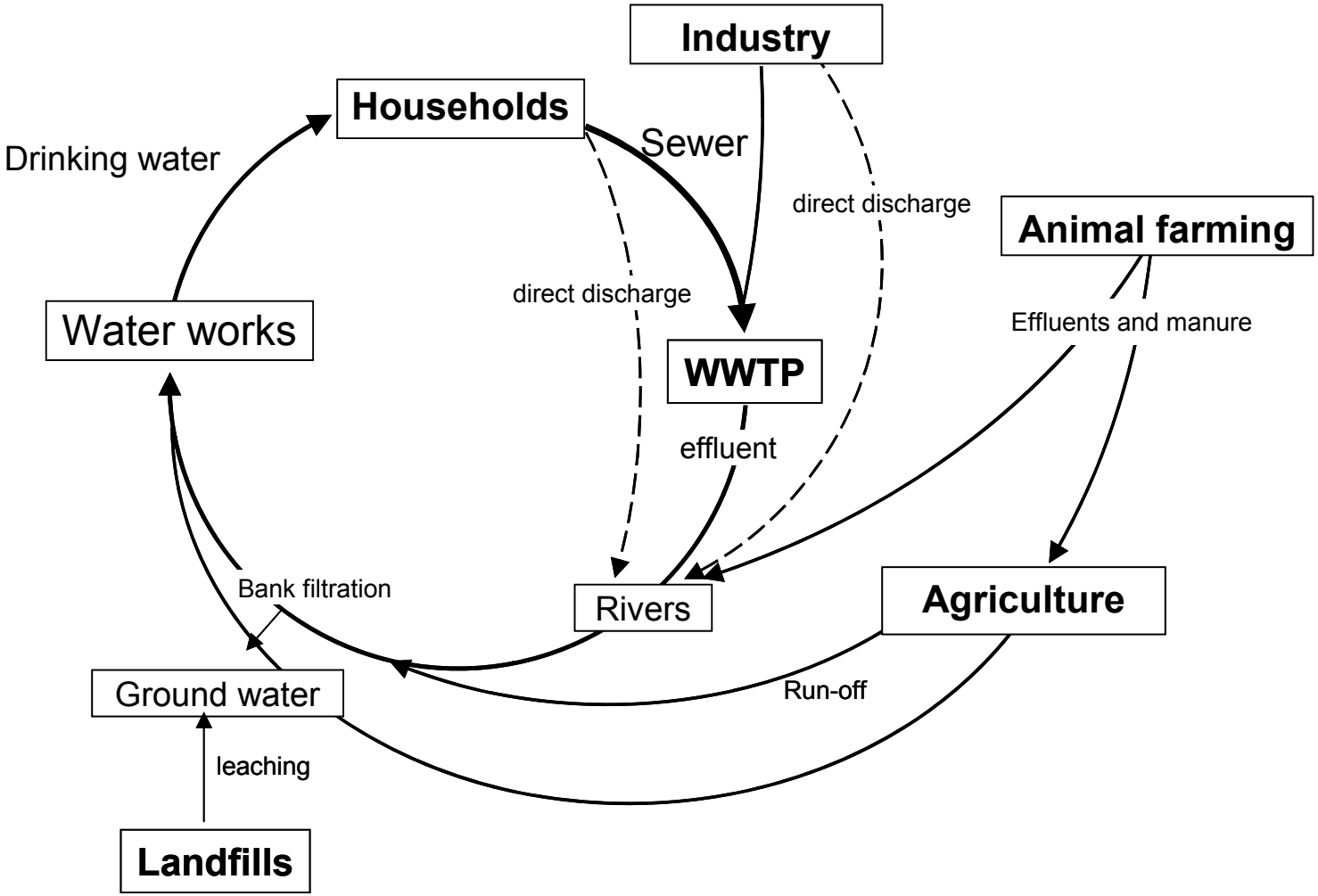
[a] diazomethane derivative, [b] pentaflourobenzyl derivative, [c] trimethylsilyl derivative, [d] tert-butyldimethylsilyl derivative

Table 3. Elimination at WWTP (activated sludge treatment). Data complied from references [12,28,37,52,55,56,57,58]

Compound	Average elimination (%)[a]	Effluent concentrations (μg/L)	Main degradation products	Observation
Non ionic surfactants				
Alkylphenol ethoxylates	90– 99	<0.1–350	APEC, CAPEC, AP	Primary degradation fast; ultimate degradation less than 40%, metabolites potential endocrine disruptors
Pharmaceuticals				
Ibuprofen	65–90	0.37-0.60 (3.4) [b]		
Diclofenac	69–75	0.06-0.81 (2.1)		Rapid photodegradation
Clofibric Acid	34–51	0.12-0.36 (1.6)		Degradation product of lipid regulating agents
Benzafibrate	83	1.1-2.2 (4.6)		
Naproxen	45–66	0.27-0.61 (2.6)		
Ketoprofen	69	0.02-0.38 (0.87)		
Gemfibrozil	46–69	0.31-0.40 (1.9)		
Carbamazepine	7	0.30-2.1 (6.3)		Low removal rate
Antiseptics				
Triclosan	44–92	0.070–0.650	Methyl triclosan	Possible photodegradation
Pesticides				
Mecoprop and MCPA	-	20–400	2-methyl-4-Cl-phenol	Application period (mid-March until mid-May)
2,4-D	-	<20	2,4-dichlorphenol	
2,4,5-T	-	<20	2,4-D ; 2,4-dichlorphenol	

[a] Primary elimination of the parent compound

[b] Range of average values detected (in parenthesis: maximum concentration detected)


Industry
Households
Sewer
Drinking water
direct discharge
Animal farming
direct discharge
Water works
Effluents and manure
WWTP
effluent
Bank filtration
Rivers
Agriculture
Ground water
Run-off
leaching
Landfills

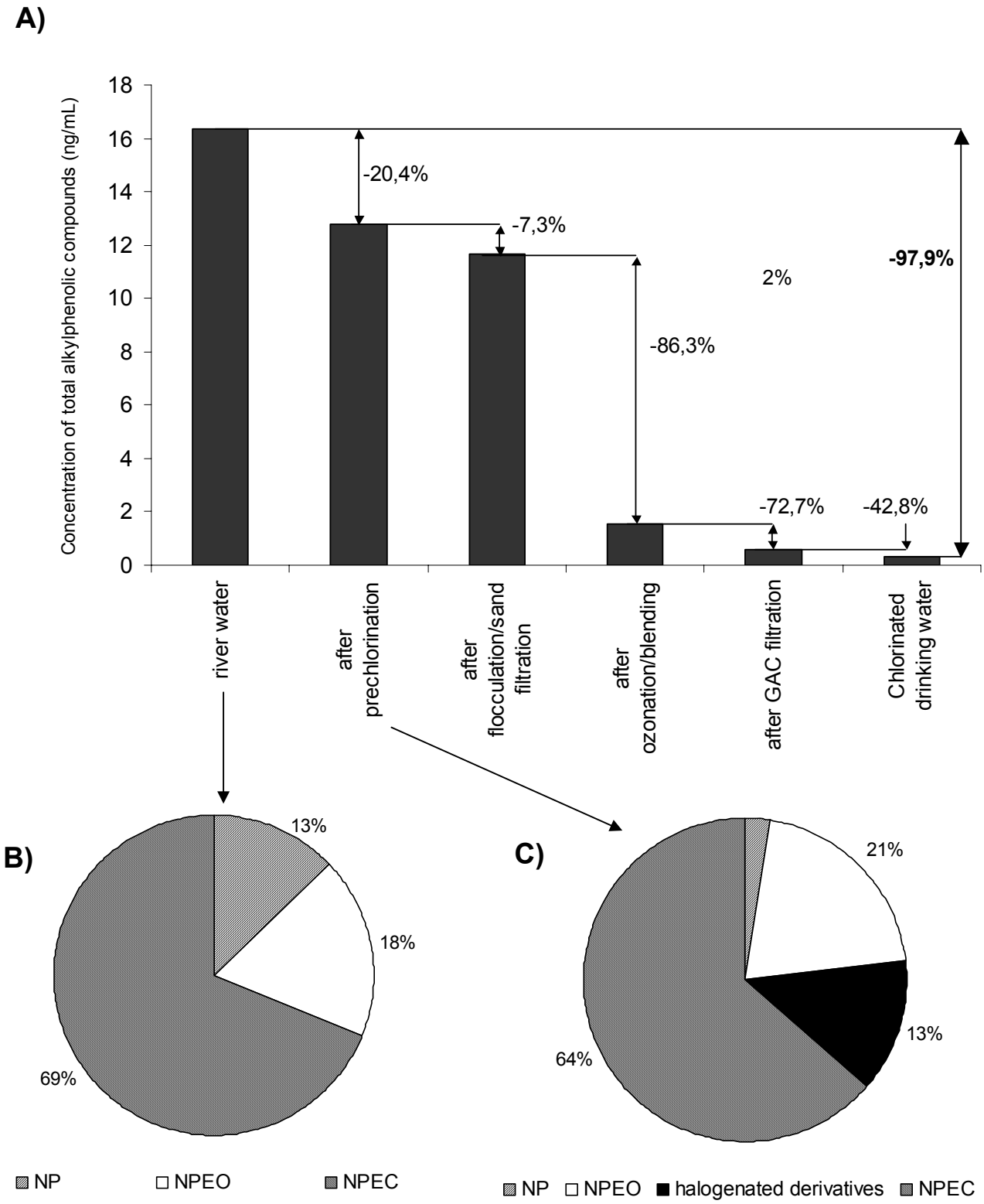

A)
Concentration of total alkylphenolic compounds (ng/mL)
18
16
14
12
10
8
6
4
2
0
-20,4%
-7,3%
-86,3%
2%
-97,9%
-72,7%
-42,8%
river water
after prechlorination
after flocculation/sand filtration
after ozonation/blending
after GAC filtration
Chlorinated drinking water
B)
13%
18%
69%
NP
NPEO
NPEC
C)
21%
13%
64%
NP
NPEO
halogenated derivatives
NPEC

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Exhibit 4

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Antibiotic Resistance Genes as Emerging Contaminants: Studies in Northern Colorado†

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This study explores antibiotic resistance genes (ARGs) as emerging environmental contaminants. The purpose of this study was to investigate the occurrence of ARGs in various environmental compartments in northern Colorado, including Cache La Poudre (Poudre) River sediments, irrigation ditches, dairy lagoons, and the effluents of wastewater recycling and drinking water treatment plants. Additionally, ARG concentrations in the Poudre River sediments were analyzed at three time points at five sites with varying levels of urban/agricultural impact and compared with two previously published time points. It was expected that ARG concentrations would be significantly higher in environments directly impacted by urban/agricultural activity than in pristine and lesser-impacted environments. Polymerase chain reaction (PCR) detection assays were applied to detect the presence/absence of several tetracycline and sulfonamide ARGs. Quantitative real-time PCR was used to further quantify two tetracycline ARGs (tet(W) and tet(O)) and two sulfonamide ARGs (sul(I) and sul(II)). The following trend was observed with respect to ARG concentrations (normalized to eubacterial 16S rRNA genes): dairy lagoon water > irrigation ditch water > urban/agriculturally impacted river sediments ($p < 0.0001$), except for sul(II), which was absent in ditch water. It was noted that tet(W) and tet(O) were also present in treated drinking water and recycled wastewater, suggesting that these are potential pathways for the spread of ARGs to and from humans. On the basis of this study, there is a need for environmental scientists and engineers to help address the issue of the spread of ARGs in the environment.

Introduction

The spread of antibiotic-resistant pathogens is a growing problem in the U. S. and around the world. Recently a 2000 World Health Organization (WHO) report (*1*) focused on antibiotic resistance as one of the most critical human health challenges of the next century and heralded the need for "a global strategy to contain resistance". According to the report, more than two million Americans are infected each year with resistant pathogens and 14 000 die as a result. The rapid growth of the problem emphasizes the need for intervention. For example, vancomycin is currently considered to be the most powerful antibiotic of "last resort", yet within 10 years the incidence of vancomycin-resistant enterococci (VRE) increased in the United States from 0% to 25% (*2*, *3*). Resistance to penicillin, the antibiotic that originally revolutionized human health 50 years ago, is now as high as 79% in *Staphylococcus pneumoniae* isolates in South Africa (*4*, *5*). Alarmingly, diseases that were once considered to be eradicated, such as tuberculosis, are now beginning to make a comeback because of antimicrobial resistance (*1*, *6*, *7*). As with other dangerous pollutants that spread in the environment and threaten human health, there is a need for environmental scientists and engineers to help address the critical problem of microbial resistance to antibiotics.

The rise of antibiotic resistance is considered to be closely linked with the widespread use of antibiotic pharmaceuticals in humans and animals. In particular, more than one-half of the antibiotics used in the U. S. are administered to livestock for purposes of growth promotion or infection treatment (*8*, *9*). In both animals and humans, up to 95% of antibiotics can be excreted in an unaltered state (*10*, *11*). Some removal has been observed in wastewater treatment plants (WWTPs); however, as is true with the larger problem of pharmaceutical compounds, WWTPs are not designed for the removal of micropollutants (*12*−*14*). Residual antibiotics thus are released into the environment where they may exert selection pressure on microorganisms. While overprescribing or other improper use/disposal of antibiotics in humans is generally considered to contribute to the problem, several studies have also linked agricultural antibiotic use with antibiotic-resistant infections in humans (*15*−*23*). For example, avoparcin, an antibiotic growth-promoter used in poultry, was recently banned in Europe because of its association with the development of vancomycin-resistant enterococci (*24*).

Because of the direct selection pressure that antibiotics exert on organisms carrying antibiotic resistance genes (ARGs), the transport pathways of antibiotic-resistant microorganisms and the ARGs that they carry are expected to be similar to the pathways of antibiotic pharmaceuticals. In fact, it is likely that ARGs persist further in the pathway, considering that in many cases they are maintained in the microbial populations even after the antibiotic selection pressure has been removed (*25*−*28*). Also, horizontal gene transfer (HGT) is a major mechanism for sharing ARGs between microbes and has been documented to occur between nonpathogens, pathogens, and even distantly related organisms, such as Gram-positive and Gram-negative bacteria (*25*, *29*−*31*). In many cases, ARGs have been discovered to occur as part of multiple antibiotic resistant (MAR) superintegrons, which may contain over 100 ARG cassettes (*32*). These MAR superintegrons cause multiple-drug resistance in organisms, meaning that even when very different antibiotics are used, one antibiotic may coselect for resistance to other antibiotics (*5*, *33*). MAR gene cassettes and ARGs are notorious for being associated with plasmids and/or transposons that facilitate HGT. Finally, even if cells carrying ARGs have been killed, DNA released to the environment has been observed to persist, to be protected from DNAse, especially by certain soil/clay compositions, and to be eventually transformed into other cells (*34*−*36*). For all of these reasons, ARGs in and of themselves can be considered to be emerging "contaminants" for which mitigation strategies are needed to prevent their widespread dissemination.

The purpose of this study was to document the occurrence of tetracycline and sulfonamide ARGs in various environmental compartments in northern Colorado. These two ARG

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groups were chosen because sulfonamide and tetracycline antibiotics have been previously characterized in Poudre River sediments and shown to relate to urban/agricultural activity (*37*). The breadth of the study included Cache La Poudre (Poudre) River sediments, dairy lagoon water, irrigation ditch water, a wastewater recycling plant (WRP), and two drinking water treatment plants (DWTPs). The hypothesis was that environmental compartments most directly impacted by urban/agricultural activity would have significantly higher concentrations of ARGs than less impacted and pristine environments. Irrigation ditch waters, which were directly adjacent to farms, were investigated as a potential pathway of ARGs from farms to the Poudre River, while the WRP and the DWTPs were explored as potential routes of human environmental input and consumption. The presence/absence of several ribosomal protection factor tetracycline ARGs and folic acid pathway sulfonamide ARGs was determined using a polymerase chain reaction (PCR) detection assay, and four commonly occurring ARGs were further quantified by quantitative real-time PCR (Q-PCR). Documenting the baseline occurrence of ARGs in a cross-section of environmental compartments will take a step toward understanding and modeling the fate and transport phenomena associated with these emerging contaminants.

Experimental Section

Poudre River Sediment Sampling. Because of its pristine origins and zonation corresponding to land use, the Poudre River has served as a good model for relating human and agricultural activities with the occurrence of antibiotic pharmaceuticals (*37*) and ARGs (*38*). Five sampling sites were the focus of this study, numbered sequentially in the direction of flow from west to east, with the following characteristics: site 1, pristine location at the river origin in the Rocky Mountains; site 2, light-agriculture-influenced area; site 3, urban-influenced area at the outlet of the Fort Collins Drake WWTP; site 4, heavy-agriculture-influenced area between Fort Collins and Greeley; and site 5, heavy-agriculture- and urban-influenced area just east of Greeley, which is a major center for the meat-packing industry. Over 90 confined animal feeding operations (CAFOs), dairies, and ranches are located between sites 3 and 5. Further attributes of the Poudre River watershed that contribute to its suitability for investigating the impacts of urban and agricultural activity on antibiotics and ARGs have been described previously (*37*, *38*).

Sediment samples were collected along the Poudre River at the five sites on August 18, 2005, October 27, 2005, and February 17, 2006. The flow rates on these three dates were 1.04, 14.19, and 0.14 $m^3\ s^{-1}$, respectively (U. S. Geological Survey station number 06752260, Fort Collins, CO). Sampling at three points in time provided insight into potential temporal variations in ARG concentrations, and the February 17th date is exactly 1 year later than a previously published sampling date (*38*). The upper sediments (about 5 cm) from the middle and two sides of a cross-section at each site were sampled and composited. Samples were collected using a shovel and mixed well in sterilized centrifuge tubes. Fifty-five grams of mixed sample at each site were stored at −80 °C for subsequent molecular analysis.

Bulk Water Sampling. Irrigation ditch waters were investigated as a potential pathway of ARGs from farms to the Poudre River. Grab samples of bulk water were collected in sterile containers from irrigation ditches on August 18, 2005, corresponding to the August sampling date of the Poudre River sediments. All irrigation ditches were located between site 4 and site 5 on the Poudre River within a 3.5 km × 2 km zone north of the river, and a total of ten locations were sampled. To investigate a potential source of ARGs within this zone, a microaerophillic dairy lagoon (~1 mg/L dissolved oxygen in the upper 1 m) and an anaerobic dairy lagoon (0 mg/L dissolved oxygen) from an anonymous farm located 8 km from site 5 were sampled on October 20, 2005. Finally, source water, and pre-chlorinated, and post-chlorinated bulk water were collected from two anonymous DWTPs and an anonymous WRP in northern Colorado in February, 2005. The DWTP was studied as a potential direct route of ARGs to consumers, and the WRP was considered a potential human input into the environment. To collect fine particulates from the dilute ditch water, DWTP, and WRP samples for subsequent analysis, 500 mL of well-mixed sample was filtered using a 0.45 μm glass fiber filter (Whatman). This concentration step was not required for dairy lagoon samples.

DNA Extraction. DNA was extracted from 0.5 g of composited sediment using the FastDNA Spin Kit for Soil (MP Biomedicals) and from 1.8 mL of dairy lagoon water using the Ultraclean Microbial DNA Kit (MoBio Laboratories, Inc.) according to manufacturer protocol. Both approaches employ a bead-beating procedure. For fine particulates collected on filters from bulk water, the filters were cut into small pieces and added directly to the extraction tubes. Extraction yield and the quality of the DNA were verified by agarose gel electrophoresis and spectrophotometry.

Detection and Quantification of ARGs. Polymerase chain reaction detection assays were used for broad-scale screening of the presence/absence of five ribosomal protection factor tetracycline ARGs (tet(BP), tet(O), tet(S), tet(T), and tet(W)) (*39*) and four folic acid pathway sulfonamide ARGs (sul(I), sul(II), sul(III), and sul(A)). Development and validation of sul primers was described in Pei et al. (*38*). Positive controls consisted of cloned and sequenced PCR amplicons obtained from Poudre River sediments. Both positive and negative controls were included in every run, and negative signals were confirmed by spiking positive control template into the sample to verify a signal. Forty cycles were used to improve chances of product formation from low initial template concentrations. Further details on reaction mixes and temperature programs are available in Pei et al. (*38*); note that annealing temperatures for tet primers vary from Aminov et al. (*39*). Two tetracycline ARGs (tet(W) and tet(O)) and two sulfonamide ARGs (sul(I) and sul(II)) that were commonly occurring according to the PCR presence/absence assays were further quantified by Q-PCR using a SybrGreen approach. For further details on Q-PCR methods, see Pei et al. (*38*). Eubacterial 16S rRNA genes were quantified according to the TaqMan Q-PCR method described by Suzuki et al. (*40*) so that ARGs could be normalized to the total bacterial community. This provided a means to correct for potential variations in extraction efficiencies. By quantification of 16S rRNA genes, it was also possible to compare ARGs proportionally between samples of different overall population sizes. Matrix effects associated with extraction of DNA from environmental samples were corrected for by performing spiked matrix control tests and determining template suppression factors as described in Pei et al. (*38*). All Q-PCR analyses were performed using a Cepheid SmartCycler (Sunnyvale, CA).

Statistics. The influences of the environment (sites, ditch water, and dairy lagoons) on the normalized and non-normalized copies of ARGs were analyzed using the Mixed Procedure, which fits a variety of mixed linear models to data. This provides the flexibility of simultaneously modeling means, variances, and covariances (*41*−*44*). Through the use of this test, it was thus possible to comprehensively compare overall differences between different environmental compartments with respect to ARG concentrations. For comparison of the five Poudre River sites, multiple sampling time points were treated as replicates. Mixed Procedures were conducted using SAS 9.0 (SAS Institute Inc., Cary, NC). A

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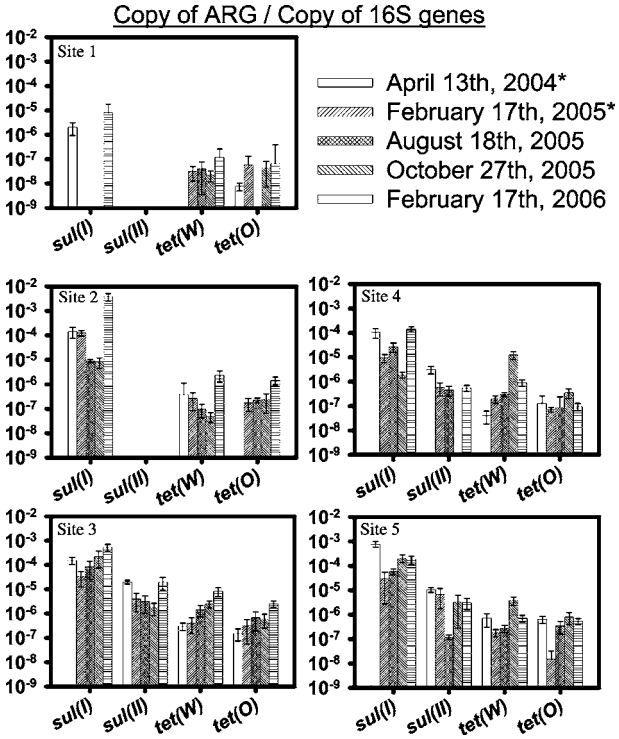

FIGURE 1. Distribution of four ARGs (sul(I), sul(II), tet(O), and tet(W)) in Poudre River sediments on three sampling dates, compared to two previously published sampling dates (April 13, 2004, and February 17, 2005 (*38*)), as determined by Q-PCR: site 1, pristine site; site 2, light agricultural activity; site 3, heavy urban activity; site 4, heavy agricultural activity; site 5, heavy urban and agricultural activity. Error bars represent the standard deviation of six measurements from three independent Q-PCR runs analyzing DNA extract from composite samples.

p-value <0.05 was considered to indicate significance. Averages and standard deviations of all data were determined using Microsoft Excel, 2003.

Results and Discussion

Occurrence of ARGs in Northern Colorado. Figure 1 summarizes the Q-PCR data obtained for the four ARGs at the five Poudre River sites, while Figure 2 summarizes the same analyses for the ditch waters and dairy lagoon water. When August 2005 data for the Poudre River sediments are compared with the dairy lagoon and ditch water, the following trend is observed with respect to ARG concentrations: dairy lagoon water > ditch water > river sediments ($p < 0.0001$), for all ARGs except sul(II), which was absent from the ditch waters. This is based on pooling of all 10 ditch water sites, the two dairy lagoons, and sites 4 and 5, which were directly adjacent to the ditch water sampling locations. Within each of these three pools, there was no statistical difference observed among the samples. Therefore, it was observed as expected that environmental compartments most directly impacted by human/agricultural activity showed higher concentrations of ARGs. This trend is even stronger in considering absolute quantities of ARGs (not normalized to 16S rRNA genes), because the concentration of cells in the dairy lagoon water was orders of magnitude higher than that of the ditch water or the sediments.

In developing a hypothetical pathway for ARGs, a trend is not as clear. The overall trend in terms of ARG concentrations of dairy lagoon water > ditch water > river sediments suggests that on-farm compartments, such as lagoons may be the source of ARGs, which are subsequently attenuated in ditch water before reaching Poudre River sediments.

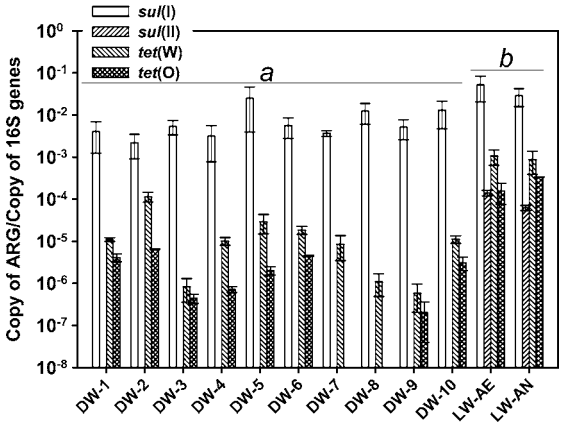

FIGURE 2. Distribution of four ARGs (sul(I), sul(II), tet(O), and tet(W)) at 10 sampling points of irrigation ditch water (DW-1−DW-10) located between site 4 and site 5 compared with that of a microaerophillic dairy lagoon (LW-AE) and an anaerobic dairy lagoon (LW-AN). DW samples were concentrated from 500 mL, and LW samples were extracted directly from 1.8 mL. All samples were normalized to the total 16S rRNA genes. Error bars represent three independent Q-PCR runs in duplicate. The labels a and b indicate that the data sets fell into two statistically different groups, according to the Mixed Procedure.

However, this trend is not supported in terms of sul(II), which is entirely absent from the ditch water and therefore cannot be the source of what is observed in the Poudre River sediments. An alternative source of the sul(II) that appears at sites 4 and 5 could instead be human inputs. This is supported by the data presented in Figure 1, in which it is observed that sul(II) is consistently present at high levels on average at site 3, which is at the point of discharge of the Drake WWTP, while consistently lower (comparing each date sampled) at site 4 (entirely absent for the October event) and equivalent or lower at site 5, which has mixed human/agricultural inputs. Because sul(II) is present in the dairy lagoon waters, it must also have agricultural sources, but it may attenuate too quickly to be transported to the ditches and subsequently to the river sediments. On the basis of this study and a previous study (*38*), it is appears that of the four ARGs quantified sul(II) is the most sensitive indicator of human/agricultural impact, and thus it is suggested that it attenuates quickly in the absence of direct inputs. The other ARGs in the Poudre River sediments at sites 4 and 5 may be of either/both human and agricultural origin, since they followed a decreasing trend from the dairy lagoon through the ditch water but were also present at site 3.

In addition to having higher concentrations of three out of four of the ARGs, the dairy lagoon water was also observed to have more different kinds of ARGs present than the irrigation ditch water according to the PCR assay (Table 1). Together with the Q-PCR results, these data further support the concept that there is some attenuation of ARGs between any linkages that may connect dairy lagoon water and irrigation ditch water. Future work should implement ARG fingerprinting/source tracking to fully characterize the potential pathways.

Temporal Variations of ARG in Poudre River Sediments. As observed in a previous study that compared a high-flow sampling point (6.8 m^3 s^{-1}, April 2004) with a low-flow sampling point (0.6 m^3 s^{-1}, February 2005), the ARG concentrations in the Poudre River sediments are variable with time (*38*). To better understand temporal variations in ARG concentrations, the Poudre River sediments were sampled at three additional time points and compared with the two previously published time points. The February sampling point in this study took place exactly 1 year after

TABLE 1. PCR Presence/Absence Assay of Various ARGs in Ditch (DW)[a] and Dairy Lagoon (LW) Water[b]

ARG	DW-1	DW-2	DW-3	DW-4	DW-5	DW-6	DW-7	DW-8	DW-9	DW-10	LW-AE	LW-AN	+ control
tet(BP)	−	−	−	−	−	−	−	−	−	−	−	−	+
tet(O)	+	+	+	+	+	+	−	−	+	+	+	+	+
tet(S)	−	−	−	−	−	−	−	−	−	−	−	−	+
tet(T)	−	−	−	−	−	−	−	−	−	−	+	+	+
tet(W)	+	+	+	+	+	+	+	+	+	+	+	+	+
sul(I)	+	+	+	+	+	+	+	+	+	+	+	+	+
sul(II)	−	−	−	−	−	−	−	−	−	−	+	+	+
sul(III)	−	−	+	+	+	−	−	−	−	−	+	+	+
sul(A)	−	−	−	−	−	−	−	−	−	−	−	−	+

[a] Collected August 18, 2005. [b] Collected October 20, 2005.

the previous February event. In support of the relationship between ARG concentration and relative environment impact observed above, the pristine site (site 1) consistently had the lowest average concentrations of ARGs with time, with sul(II) completely absent and no individual ARG consistently present at all five sampling times (Figure 1). When presence/absence of ARGs are compared, site 2 appears to be the next lowest in terms of overall impacts. For example, sul(II) is consistently absent at site 2, and tet(O) was absent in one of the five sampling events, whereas these genes were consistently present at sites 3, 4, and 5. In terms of ARG concentrations, tet(W) and tet(O) at site 2 were equal or less than site 3; however, these two genes were sometimes higher and sometimes lower than at sites 4 and 5. On the basis of ARG averages and presence/absence of ARGs, sites 1 and 2 were the least impacted, as expected.

When the Mixed Procedure was applied to the data, in which the time points were pooled as replicates, it was found that there was no statistical difference between the five sites for the 16S normalized data, except in the case of sul(II) ($p = 0.0117$). However, when the same test was performed with non-normalized data, it was found that sites 1 and 2 were statistically lower than sites 3, 4, and 5 in terms of sul(I) ($p = 0.00296$), sul(II) ($p = 0.0199$), and tet(O) ($p = 0.0102$). Though normalizing to 16S genes provides a comparison of ARGs as a proportion of the total population, arguably it may be the absolute quantities of ARGs that are more critical.

While spatial variations in ARGs could be fairly well-characterized, it is difficult to identify clear temporal patterns. Comparison of the two February sampling dates that were exactly a year apart provides some insight. All four genes were either the same on average for both events (tet(O) for sites 1 and 4 and sul(II) for sites 4 and 5) or higher in the 2006 event (all other genes, except sul(II) at sites 1 and 2, where it was not present) (Figure 1). This suggests the possibility that all ARGs are increasing in concentration with time. However, the trends in between these two dates do not support this. Only tet(W) and tet(O) at site 3 increase consistently with time. All remaining ARGs at the five sites either decrease before increasing (e.g., tet(W) at site 2 and sul(II) at site 3), are constant and then increase (e.g., tet(O) at site 2 and tet(W) at site 1), or increase and then decrease (e.g., tet(W) at sites 4 and 5) (Figure 1). Therefore, no clear trend was identified with time.

It was also attempted to analyze trends in the data with respect to river flow rate. This was of interest because flow rate directly relates to runoff and nonpoint source inputs, which were hypothesized in the previous study to play a role in the observed increase in the number of kinds of ARGs detected in Poudre River sediments (*38*). The October 2005 sampling date provided a second sampling date at high flow (14.9 $m^3\ s^{-1}$), compared to the previously published April 2004 high-flow sampling date (6.8 $m^3\ s^{-1}$). (All other dates were at or below 1.0 $m^3\ s^{-1}$.) Interestingly, all four ARGs increased on average at site 5 in comparing the high-flow October event with the immediately previous low-flow event in August (Figure 1). At site 4, tet(W) and tet(O) increased, but sul(II) stayed the same, and sul(I) decreased. There was no effect at all at site 3, which is affected primarily by point discharge rather than runoff, site 2, or site 1. However, attempts to plot ARG concentrations versus flow rate did not reveal any clear trend. Thus, it is still not possible to make a conclusive judgment on the effect of flow rate on ARG concentrations, though the role of nonpoint source inputs merits further investigation. To accomplish this, it would be necessary to gather more data with time/flow or monitor a much more controlled and smaller-scale system.

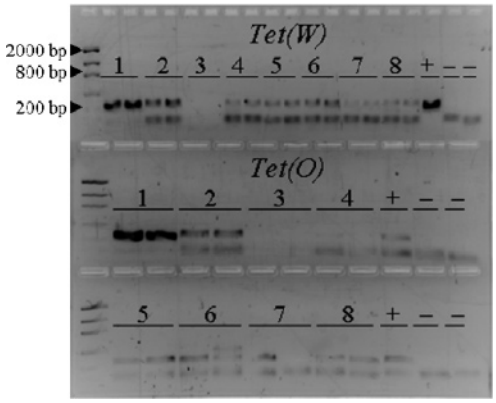

FIGURE 3. Agarose gel analysis of PCR presence/absence (in duplicate) of two ARG families, tet(W) and tet(O): + = positive control; − = negative control. The presence of a band at the same molecular weight as + indicates the presence of an ARG: 1 = WRP effluent; 2 = WRP chlorinated effluent; 3 = DWTP a influent; 4 = DWTP a treated water pre-chlorination; 5 = DWTP a treated water post-chlorination; 6 = DWTP b influent water; 7 = DWTP b treated water pre-chlorination; 8 = DWTP b treated water post-chlorination. The band appearing below 200 bp is consistent with a primer dimer.

Wastewater Recycling Plant and Drinking Water Treatment Plants. A PCR presence/absence assay was conducted on the influent, intermediate effluent, and final effluent of two drinking water treatment plants (DWTP "a" and DWTP "b") and the pre-chlorinated and chlorinated effluent of a WRP. It was observed that both tet(W) and tet(O) were present at detectable levels in all samples except the source water for DWTP "a" (Figure 3). This indicates that the same two genes that were common in various environmental compartments in northern Colorado are also present in treated recycled wastewater and bulk drinking water. These two genes also showed a response to the level of impact; e.g., they were highest in dairy lagoon water and ditch water and lowest on average at the pristine site. On the basis of the intensity of the signal, they were also higher in the recycled wastewater than in the drinking water, as would be expected. Though these two ARGs are not directly associated with any known human pathogens, they may be indicators of links

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between human/agricultural activity and ARGs in drinking water. Considering that drinking water is a direct route to human consumers, this emphasizes the need to better understand the pathways by which ARGs are spread in the environment and potential ways that the spread of ARGs may be reduced. For example, vancomycin resistance genes were found in drinking water biofilms in a recent study (*45*). Considering that vancomycin is typically the antibiotic of last resort when all else fails, this underscores the need to address this issue before it is too late. One possibility may be to make simple modifications to wastewater and drinking water treatment plants to reduce the spread of ARGs.

ARGs as Emerging Contaminants. On the basis of this study it is clear that ARGs are present in various environmental compartments, including river sediments, irrigation ditch water, dairy lagoon water, DWTPs, and a WRP. Furthermore, quantitative techniques incorporating Q-PCR provide a means to compare the concentrations of ARGs associated with the known urban and agricultural impacts, which provides a more direct measure than previous culture-based methods. On the basis of this occurrence survey, it is argued that ARGs are emerging contaminants that need to be further studied in the paradigm of environmental science and engineering. The concept of ARGs as "pollutants" has also been suggested by Rysz and Alvarez (*46*).

It should be noted that besides the tetracycline and sulfonamide ARGs that were the focus of this study, there are numerous other ARGs that have been described in the literature and likely even more that have not yet been discovered, each potentially with its own unique properties. Thus, each ARG may have different behaviors with respect to fate and transport and response to physical, chemical, and/or biological treatment. In terms of defining fate and transport characteristics of ARGs in general, it is expected that their behavior will be distinct in comparison to "typical" contaminants. For example, ARGs may be sequestered with bacteria, which are themselves transported, or they may be present as naked DNA bound to clay particles (*47*). Furthermore, ARGs may actually amplify in the environment under some conditions. This is indeed a unique contaminant property. Considering the significance of the problem of the spread of antibiotic resistance, further effort by environmental researchers to better understand these emerging contaminants is well-warranted. This is especially true as the rate of discovery and development of new antibiotics is continually declining (*48*), while the corresponding development and spread of resistance is occurring at a rapid pace. On the basis of this study, understanding ARGs as emerging contaminants can add a new and important angle to helping to approach this important problem.

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March 11, 2011

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Via E-Mail to dlacaro@waterboards.ca.gov

Re: Waste Discharge Requirements for the Los Osos Water Recycling Facility (Draft Order No. R3-2011-0001 & Draft MRP Order No. R3-2011-0001)

Dear Mr. LaCaro:

We submit these comments on behalf of our client, Citizens for a Sustainable Community (Citizens), for consideration by the Central Coast Regional Water Quality Control Board (CCRWQCB) in deciding whether to approve the waste discharge requirements (WDRs) proposed for the Los Osos Water Recycling Facility (LOWRF), a project of the County of San Luis Obispo (County).[1] For the reasons set forth below and based on the additional information contained in the attached addendum and exhibits, we request that before the CCRWQCB takes any action approving the draft WDRs, it order preparation and public circulation of a subsequent or supplemental environmental impact report (SEIR), and consider the information in that SEIR. Such a course of action is mandated by the California Environmental Quality Act (CEQA) (Pub. Res. Code § 21000 et seq.) and the State CEQA Guidelines (Guidelines) (Cal. Code Regs., tit. 14, § 15000 et seq.), among other things, due to new information of substantial importance that was not known -- indeed, did not exist -- and could not reasonably have been known and considered in 2009, when the County certified the environmental impact report (EIR) for the LOWRF project

[1] Please note that in the addendum attached to this letter, the LOWRF project is referred to as the Los Osos Wastewater Project (LOWWP) -- the project name used by the County.

(acting as lead agency under CEQA).[2] Furthermore, as proposed, the CCRWQCB's action on the project will violate CEQA for additional reasons and will also violate the Porter-Cologne Water Quality Control Act (Porter-Cologne Act) (Water Code § 13000 et seq.).

The CCRWQCB correctly notes that because it has discretionary review and approval power over the LOWRF project through its statutory responsibility to prepare WDRs, the CCRWQCB is a "responsible agency" within the meaning of CEQA for the purpose of environmental review of and action on the WDRs. (Guidelines, § 15381; see also § 21069.) An activity that involves the issuance to a person of a lease, permit, license, certificate, or other entitlement for use by one or more public agencies is subject to the CCRWQCB's CEQA review. (See § 21065, subd. (c).)

The CCRWQCB Must Prepare an SEIR and Comply with Its Duties as a Responsible Agency Under CEQA Before Approving the Draft WDRs.

Section 21166 and Guidelines sections 15162 and 15163 require the preparation of an SEIR when (1) substantial changes occur with respect to the circumstances under which a project is undertaken, such that revisions of the EIR are necessary due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects; or (2) new information of substantial importance which was not known and could not have been known with the exercise of reasonable diligence when the EIR was certified becomes available, showing that: (i) the project will have one or more significant effects not discussed in the EIR; (ii) significant effects previously examined will be substantially more severe than shown in the EIR; (iii) mitigation measures or alternatives previously found infeasible would in fact be feasible and would substantially reduce one or more significant effects of the project; or (iv) mitigation measures or alternatives considerably different from those analyzed in the previous EIR would substantially reduce one or more significant effects on the environment.

Substantial changes in physical baseline conditions under which the LOWRF project is undertaken have occurred and new information, including hydrologic data, has become available, meeting the criteria of section 21166 and Guidelines section 15162. The Los Osos Basin Plan Update publicly released in May 2010 (over seven months after certification of the EIR) by an interagency working group consisting of representatives from the County and the area's three major water purveyors shows rapidly accelerating seawater intrusion into the Los Osos Valley groundwater basin, the region's only drinking water source. As the CCRWQCB's staff report notes, according to the 2009 EIR, based on investigation data between 1985 and 2005, the rate of seawater intrusion into aquifer zones D and E are *60 and 54 feet per year*, respectively, but the May 2010 Basin Update now shows that the seawater wedge has extended into the same aquifer through fingers at the significantly higher rate of *700 feet per year*. The plume now reaches as far inland as a well near Los Osos Community Park and Los Osos Valley Rd. The saltwater movement data thus indicate a substantially more severe public health threat to water supply than previously known, and the County and the relevant water agencies no longer believe water demand is within safe yield (+/- 3,200 AFY) without measures counteracting this change.

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[2] All unlabeled section (§) references in this letter are to CEQA provisions contained in the Public Resources Code.

Additional independent expert review of the Plan Update by Mr. Eugene Yates, a hydrogeologist, confirms that the recently discovered substantially accelerating seawater intrusion into the basin is an "extremely urgent" problem that requires urgent action, including 500 AFY of reduced pumping from the urban compartment. (Review dated August 3, 2010, at 1 [attachment #3 to our addendum].) Yates also recommended the review of a wide range of mitigation options to address changes in basin conditions, given that the LOWRF project, in conjunction with the increased pumping from the upper aquifer may induce seawater intrusion *in the upper aquifer*. Yates opined that accelerating seawater intrusion makes the LOWRF project's recycled water reuse program -- viewed as key mitigation for the LOWRF -- outdated, and may indeed make it nonviable.

The changed baseline conditions and new information are important as there is a direct nexus between seawater intrusion in the Los Osos groundwater basin, the rate thereof and the LOWRF project. As designed, the project, which includes the decommissioning of the onsite wastewater disposal systems in the prohibition zone, contributes to the environmental and public health effects (sodium contamination of the freshwater) of seawater intrusion by reducing groundwater recharge.[3] As noted in the Hopkins Groundwater Consultants report prepared for the 2009 EIR, project operation results in a net deficit of groundwater recharge and aquifer volume. The changed baseline conditions and new information concerning changes in the basin's freshwater/seawater interface thus are highly relevant to the CCRWQCB's environmental review of the LOWRF project, since with substantially accelerated landward saltwater movement into the drinking water reservoir, public health effects will now be substantially exacerbated, and the project will result in new, as yet unexamined, indirect and cumulative significant effects, including public health effects.[4] In this instance, for the CCRWQCB to "use its best efforts to find out and disclose all that it reasonably can," and conduct "thorough investigation," as it must under CEQA (Guidelines, §§ 15144, 15145), goes to the heart of the CCRWQCB's healthy watersheds vision. That vision is one of keeping groundwaters "near natural levels in quantity and quality for water supply purposes and for base flow for sustaining creek habitat, and migratory fish routes," while protecting watersheds "from hydromodification that adversely affects recharge area functions, or the stability of creeks' beds or banks." (CCRWQCB Dec. 11, 2011 Vision Message, at 1-2 & fn. 2 [<http://www.swrcb.ca.gov/centralcoast/publications_forms/publications/vision/docs/Agencies_ltr.pdf>, as of March 10, 2011].) Yet, as proposed, the WDRs include no "end-of-pipe" requirements or mitigations to reduce or

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[3] Loss of groundwater recharge lowers the water level (head) in the aquifer, which reduces the flow of freshwater to seawater. This flow reduction, in turn, allows inland movement of the seawater-freshwater interface. (See, e.g., U. S. Geological Survey, *Saltwater Intrusion in Los Angeles Area Coastal Aquifers-The Marine Connection* (2002 Fact Sheet) [<http://pubs.usgs.gov/fs/2002/fs030-02/>, as of March 10, 2010]; Frederick, *America's Water Supply: Status and Prospects for the Future* (Consequences, vol. 1, No. 1, Spring 1995) [< http://www.gcrio.org/CONSEQUENCES/spring95/Water.html>, as of March 10, 2011].)

[4] " 'Significant effect on the environment' means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance." (Guidelines, § 15382.)

avoid the combined direct, indirect and cumulative effects of the substantially changed groundwater baseline conditions and LOWRF project on groundwater quantity and quality.[5] Consistent with CEQA, we thus request public review in an SEIR of (1) the major change in physical baseline conditions affecting groundwater sustainability represented by the significantly increased saltwater movement into the basin; and (2) the combined environmental effects (including public health effects) of this change and the LOWRF project, including the relationship of the change to -- and the cumulative effects thereof on -- the changes in aquifer dynamics and freshwater storage that result from the implementation of the LOWRF project. SEIR assessment of the seawater intrusion impacts of the LOWRF project and of the comparative impacts of feasible wastewater treatment alternatives must be performed, and mitigation measures correlated to the actual severity of the impact (the real, anticipated salinity levels and their distribution) must be developed and implemented, based on specific, measurable, enforceable and verifiable performance standards. This SEIR assessment is critical to informed decisionmaking and public participation in the WDRs review and approval process. The post-2009 EIR information now available to the CCRWQCB negates the assumptions of hydrogeological and hydrochemical equilibria in baseline water conditions upon which the County EIR assessments and mitigations were based. Under those circumstances, should the CCRWQCB approve the WDRs, CEQA mandates preparation of an SEIR so the CCRWQCB and the public may be adequately informed of relevant, substantial or potentially substantial adverse environmental effects of the LOWRF project, considered in the *actual,* full hydrogeological and hydrochemical context, and based on *current* hydrogeological and hydrochemical data and environmental assessment using modeling that accounts for appropriate margins of safety.

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[5] "Clean groundwater" is one of the three central tenets of the CCRQQCB's healthy watersheds vision, which, as cogently stated on the CCRWQCB's Website, serves "to empower people to act on the important issues facing the Central Coast Region over the next 20 years." (<http://www.swrcb.ca.gov/centralcoast/publications_forms/ publications/vision/teams.shtml> [as of March 10, 2011].) Substantially accelerated seawater intrusion in the Los Osos Valley groundwater basin surely is one such issue. Because this hydrogeological process occurs in the area affected by the LOWRF project, it cannot be severed from the CCRWQCB's review of the WDRs. CEQA requires that physical baseline conditions affected by a project be disclosed in the environmental review document of the agency called upon to take permitting action for that project. As provided in Guidelines section 15125, subdivision (c): "Knowledge of the regional setting is critical to the assessment of environmental impacts. *Special emphasis* should be placed on environmental resources that are *rare or unique* to that region and would be affected by the project. The EIR [or, in this case, an SEIR] must demonstrate that the significant environmental impacts of the proposed project were adequately investigated and discussed and it must permit the significant effects of the project to be considered *in the full environmental context*." (Emphasis added.) Considering its high level beneficial use, the groundwater resource here surely is rare and unique to the region and the population that depends on it. (See also *County of Amador v. El Dorado County Water Agency* (1999) 76 Cal.App.4th 931, 954-955 [for adequate environmental assessment of fisheries, river habitat and recreational use impacts of lake water withdrawals associated with a water supply project, the permitting agency must disclose and evaluate relevant information on baseline lake levels, including rates of existing releases]; CEQA Guidelines, § 15126.2, subd. (a) [EIR should address, inter alia, the "health and safety problems caused by the physical changes, and other aspects of the resource base such as water … and public services"].)

Whenever an agency with discretionary approval authority over a permit or other entitlement for use for a project makes an approval decision, and the final EIR for the project fails to provide the environmental information disclosure mandated by CEQA, or is not supplemented to account for substantially changed circumstances in physical baseline conditions or to review significant new environmental information relevant to the project, the decision is a prejudicial abuse of discretion, and, therefore, a nullity. (See *Communities for a Better Environment v. City of Richmond* (2010) 184 Cal.App.4th 70, 88 [an agency's " 'ultimate decision of whether to approve a project, be that decision right or wrong, is a nullity if based upon an EIR that does not provide the decision-makers, and the public, with the information about the project that is required by CEQA' "]; *Mira Monte Homeowners Assn. v. County of Ventura* (1985) 165 Cal.App.3d 357, 361, 364-365 [failure to prepare an SEIR after resurvey of project site revealed significant new information, i.e., a greater seasonal wetlands impact than previously identified, nullified approval decision because it prevented consideration of "the full range and effectiveness of alternatives and mitigation measures"].)

Importantly, as a responsible CEQA agency, the CCRWQCB cannot defer to the County regarding whether or not to prepare an SEIR. By CEQA, the CCRWQCB must reach its own conclusions on whether and how to approve a project, based not only on its review of the environmental document prepared by the lead agency, but also any new information in an SEIR which the CCRWQCB must prepare where, as here, SEIR review is mandated. (See Guidelines, §§ 15020, 15052, 15096, subd. (a), 15162, 15163; *Save San Francisco Bay Assn. v. San Francisco Bay Conservation and Development Com.* (1992) 10 Cal.App.4th 908, 932; *id*. at 921-922 [responsible agency must "conduct its own analysis using its own special expertise" before "reach[ing] its own conclusions"].) As discussed in greater detail in the attached addendum, Guidelines section 15052 requires the CCRWQCB to step into the shoes of the County, and prepare (or contract preparation of) an SEIR prior to approving WDRs for the LOWRF project, because: (1) the prerequisites under section 21166 and Guidelines section 15162 for an SEIR are established; and (2) prior to the CCRWQCB's action, the lead agency (County) granted a final discretionary approval for the LOWRF project and the statute of limitations for challenging that approval has expired. (County approval occurred on September 29, 2009. The statute of limitations expired in 2009 -- 30 days after the posting of the County's notice of determination which gave public notice of the September 29, 2009 decision.)

Importantly, even absent -- yet especially because of the presence of -- the new physical baseline conditions and the new information summarized above, the CCRWQCB, as a responsible agency, must mitigate or avoid "the direct or indirect environmental effects of those parts of the project which it decides to carry out, finance, or approve." (Guidelines, § 15096, subd. (g)(1).) Also, "[w]hen an EIR has been prepared for a project, the Responsible Agency shall not approve the project as proposed if the agency finds any feasible alternative or feasible mitigation measures within its powers that would substantially lessen or avoid any significant effect the project would have on the environment." (Guidelines, § 15096, subd. (g)(2).) Finally, before approving the WDRs, the CCRWQCB must "make the findings required by [Guidelines] Section 15091 for each significant effect of the project and shall make the findings in [Guidelines] Section 15093 if necessary." (Guidelines, § 15096, subd. (h); see *Save San Francisco Bay Assn.*, 10 Cal.App.4th 908, 921-922, 932.)

The CCRWQCB thus clearly has a duty to mitigate or avoid the adverse impacts of the LOWRF project. The discretionary approval currently before the CCRWQCB involves mitigation for the LOWRF project's impacts to hydrology and water quality. The CCRWQCB staff report asserts that the CCRWQCB has no duty to make specific findings pursuant to Guidelines section 15096, subdivision (h), because the EIR did not identify any potentially significant impacts within the CCRWQCB's jurisdiction. This conclusion is unsupported, in light of both the new information discussed above, and previous information contained in the 2009 EIR itself, which identifies project impacts to federally regulated waters as potentially significant. Those impacts are within the CCRWQCB's jurisdiction. Specifically, construction of pipelines that will be suspended over two federally regulated creeks (Los Osos Creek and Warden Creek) will result in construction impacts to these creeks. As such, the County may have to obtain (a) a Clean Water Act section 401 Water Quality Certification from the CCRWQCB; and (b) a Clean Water Act section 404 permit from the U. S. Army Corps of Engineers, necessary for discharges of dredged or fill material into the federally regulated creeks. Both the staff report and the WDRs fail to describe and evaluate this potentially significant impact. Further, despite the EIR's identification of this potentially significant impact, the WDRs contain no findings regarding the project's effects on federally regulated waters, or potentially feasible alternatives or mitigation measures which would avoid or substantially lessen the effects.

In any event, given the changed water baseline conditions and the new information that has become available following certification of the 2009 EIR, the CCRWQCB must do more than prepare findings tracking the requirements of Guidelines section 15096, subdivision (h). It must prepare and circulate an SEIR, and explore and impose (following public review of the SEIR) feasible mitigation measures or a feasible alternative to the LOWRF project as proposed. Regardless of bureaucratic or political momentum behind the County's project, the next responsible agency must follow the law. It cannot simply defer to the lead agency without assuming its own CEQA duties, including its duties under section 21166 and Guidelines sections 15052, 15162 and 15096.

<u>The WDRs Unlawfully Defer Environmental Review Regarding Location and Impacts of Discharges from the LOWRF Project.</u>

The CCRWQCB staff report states that the County "included a list of areas proposed for disposal in its report of waste discharge application." (Staff report at 2; proposed WDRs at 2.) But these areas remain unspecified, and the list is not disclosed, let alone discussed in the staff report or the WDRs. The list appears to be nonbinding anyway. We are told, indeed, that "Details of the Discharger's reuse program are not yet available[,]" and that the reuse program has yet to be developed. (*Id.*)[6] The long and the short of it is: except for the Broderson leach field (Discharge

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[6] The staff report and the proposed WDRs, by use of four separate bullet points, confusingly refer to four separate "discharge points," as follows:

> "• Discharge Point 1: Agricultural reuse irrigation at 25 different locations.
> "• Discharge Point 2: Broderson leach field.
> "• Discharge Point 3: Bayridge Estates leach field at 2 locations.
> "• Discharge Point 4: Urban reuse irrigation at 10 different locations."

Point 2) and (perhaps) the two locations of the Bayridge Estates leach field (Discharge Point 3), the CCRWQCB is being requested to approve WDRs for many unspecified discharge locations, that is, without knowing where much of the wastewater the discharges of which it must permit will be discharged.

This is a startling request, as is the gap in information regarding where wastewater discharge impacts will occur, and thus what their onsite and their offsite (runoff) effects will be. The informational gap precludes assessment of water quality impacts, which is key to the CCRWQCB's decision on the WDRs. Moreover, the list of proposed disposal areas in the WDRs omits identification of any discharge location consistent with County condition of approval No. 97, which requires at least 10 % of the treated wastewater to be reserved for environmental enhancement, including the protection of local Environmentally Sensitive Habitat Areas.

Knowledge of the specific wastewater discharge locations is of the outmost importance, especially because recycled wastewater is not contaminant free. (See, e.g., Comments of Edo McGowan, attached as exhibit 1.) It contains antibiotic resistant genes (ARGs) and contaminants of emerging concern (CECs). CECs include persistent organic pollutants (e.g., chemicals used in flame retardants; pharmaceuticals and personal care products; veterinary medicines; endocrine-disrupting chemicals (e.g. synthetic estrogens and androgens affecting hormonal functions in aquatic organisms); and nanomaterials (e.g., carbon nanotubes). (See U.S. E.P.A. OW/ORD Emerging Contaminants Workgroup, *Aquatic Life Criteria for Contaminants of Emerging Concern* (June 3, 2008), attached hereto as exhibit 2, at 2.) Numerous scientific articles and studies have investigated both CECs and ARGs in treated wastewater and have documented the health risks they pose to humans and wildlife -- addressing, for example, limb malformations and behavioral abnormalities, decreased reproduction, increased susceptibility to predation, and increased vulnerability to parasites, disease and UV radiation in amphibians and fish. (See *id.*; Petrovic, et al., *Analysis and Removal of Emerging Contaminants in Wastewater and Drinking Water* (2003), attached hereto as exhibit 3, at 3-5; Pruden, et al., *Antibiotic Resistance Genes as Emerging Contaminants: Studies in Northern Colorado* (2006) 40 Envtl. Science & Technology 7445, attached hereto as exhibit 4, at 1.)

The Porter-Cologne Water Quality Control Act requires identification of all discharge locations before the WDRs may be approved. By Water Code section 13263, the CCRWQCB must "prescribe requirements as to the nature of any proposed discharge . . ., *with relation to the*

(*Id.*) Evidently, 25 unspecified locations for agricultural reuse irrigation plus ten unspecified locations for urban reuse irrigation amounts to more than four discharge points. The staff report and the WDRs also reference as an attachment a barely legible map which shows several tiny squares scattered throughout an approximately six-square mile area, vaguely suggesting some of the reuse locations, all without indicating what agricultural lands or urban properties are being referenced, what they are being used for (e.g., turf at local schools, presenting risks of human contact with wastewater?), or whether their needs for recycled water are actually unmet. The map is vaguely illustrative and nonbinding at best. It does not refer to any specific selected wastewater discharge locations. That much is clear from the staff report.

conditions existing in the disposal area or receiving waters upon, or into which, the discharge is made or proposed." (Water Code, § 13263, subd. (a), emphasis added.) The plain language of this statutory provision makes clear that for the CCRWQCB to be able to prescribe WDRs as to the nature of any discharge proposed by the County, disclosure and analysis of site-specific baseline conditions at the discharge locations is necessary. The Legislature did not intend for regional water quality control boards to prescribe requirements "*with relation to* conditions existing in the disposal area" (Water Code, § 13263, emphasis added), without informing themselves, disclosing and evaluating those conditions.

The conditions existing in the disposal area or receiving waters impacted by proposed discharges are the physical baseline conditions affected by a project subject to WDRs. Therefore, CEQA, too, requires that the CCRWQCB identify the wastewater discharge locations. (See *Communities for a Better Environment v. South Coast Air Quality Management Dist.* (2010) 48 Cal.4th 310, 321 ["the impacts of a proposed project are ordinarily to be compared to the actual environmental conditions existing at the time of CEQA analysis, rather than to allowable conditions defined by a plan or regulatory framework"; thus, "the baseline for CEQA analysis must be the 'existing physical conditions in the affected area' [citation], that is, the ' "real conditions on the ground" ' [citations]"]; *County of Amador*, 76 Cal.App.4th 931, 952 ["It is only against [the] baseline [of the existing environmental conditions] that any significant environmental effects can be determined"]; *Sundstrom v. County of Mendocino* (1988) 202 Cal.App.3d 296, 308-309.)

In *Sundstrom*, the project applicant wanted to build a motel which necessitated the construction of a private sewage treatment plant. The mitigated negative declaration for the project included a requirement that the applicant obtain approval of a sludge disposal plan from the regional water quality control board, but did not disclose the sludge disposal location. The appellate court held that by dismissing the impact as insignificant without disclosure of a suitable sludge disposal site, the permitting agency failed to comply with CEQA.

A related CEQA issue pertaining to the LOWRF project's recycled water program arises out of the proposed condition that the County "develop an Engineering Report on the Production, Distribution and Use of Recycled Water" for later review and approval by the CCRWQCB's Executive Director. (WDRs at 13; CCRWQCB staff report at 4.) But environmental review and approval of the production, distribution and use of recycled water -- an integral element of the LOWRF project -- cannot be so segregated from the project, deferred to the future and delegated away by the permitting agency's decisionmaking body. As *Sundstrom* explains, at page 307:

> "A study conducted after approval of a project will inevitably have a diminished influence on decisionmaking. Even if the study is subject to administrative approval, it is analogous to the sort of post hoc rationalization of agency actions that has been repeatedly condemned in decisions construing CEQA."

Should the CCRWQCB not wish to conduct SEIR review, which would adequately inform its decision on the WDRs, it has the option of denying the WDRs outright. (See § 21080, subd. (b)(5) [an agency's rejection of a project is exempt from CEQA review].) As a responsible agency under CEQA, the CCRWQCB may indeed "refuse to approve" the WDRs "to avoid direct or indirect environmental effects of that part of the project which [as the] responsible agency [it is] called on to

carry out or approve." (Guidelines, § 15042.) However, if the CCRWQCB does not choose such course of action, the environmental issues raised above and those identified in our addendum (and supporting attachments) must be addressed and resolved in an SEIR. An SEIR should consider in-depth reasonable alternatives, including a septic tank effluent pumping system or other alternatives and mitigation measures that more effectively avoid or minimize the environmental impacts of the LOWRF project as currently proposed, while demanding substantially less public funding (and hence less economic burden on the community that must pay for it).

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Enclosures

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Introduction: Applicable Statutory and Regulatory Background and Support for a Subsequent/Supplemental EIR, an EIS, or a Supplemental EA.

The following statutes, laws and policies provide legal bases for the preparation, circulation and certification of a subsequent or supplemental environmental impact report (SEIR), an environmental impact statement (EIS) or, at the very least, a supplemental or revised environmental assessment (supplemental EA) for upcoming actions and decisions by the State Water Resources Control Board (SWRCB), the Central Coast Regional Water Quality Control Board (CCRWQCB), the U.S. Department of Agriculture (USDA), and other responsible agencies, concerning the Los Osos Wastewater Project (LOWWP). Further environmental review prior to any financial or other public agency commitments to the LOWWP is essential to address major changes in project conditions and circumstances under which the project is being undertaken, new information of substantial environmental importance and as yet unmitigated impacts, and to correct flaws, to prevent disastrous environmental, social and economic impacts in the Los Osos/South Morro Bay area -- the area affected the centralized conventional-gravity waste water treatment option the LOWWP would implement.

The California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.) and the State CEQA Guidelines (Guidelines) (Cal. Code Regs., tit. 14, § 15000 et seq.), require the preparation and circulation of a subsequent EIR under the following circumstances:[1]

"When an environmental impact report has been prepared for a project pursuant to [CEQA], no subsequent or supplemental environmental impact report shall be required by the lead agency or by any responsible agency, unless one or more of the following events occurs:

> "(a) Substantial changes are proposed in the project which will require major revisions of the environmental impact report.
>
> "(b) Substantial changes occur with respect to the circumstances under which the project is being undertaken which will require major revisions in the environmental impact report.
>
> "(c) New information, which was not known and could not have been known at the time the environmental impact report was certified as complete, becomes available."

(§ 21166.) Guidelines section 15162 further specifies in pertinent part:

> "(a) When an EIR has been certified … for a project, no subsequent EIR shall be prepared for that project unless the lead agency determines, on the basis of substantial evidence in the light of the whole record, one or more of the following:

[1] All unlabeled section (§) references in this document are to the Public Resources Code.

> "(1) Substantial changes are proposed in the project which will require major revisions of the previous EIR … due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects;
>
> "(2) Substantial changes occur with respect to the circumstances under which the project is undertaken which will require major revisions of the previous EIR … due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects; or
>
> "(3) New information of substantial importance, which was not known and could not have been known with the exercise of reasonable diligence at the time the previous EIR was certified as complete … shows any of the following:
>
> "(A) The project will have one or more significant effects not discussed in the previous EIR …;
>
> "(B) Significant effects previously examined will be substantially more severe than shown in the previous EIR;
>
> "(C) Mitigation measures or alternatives previously found not to be feasible would in fact be feasible, and would substantially reduce one or more significant effects of the project, but the project proponents decline to adopt the mitigation measure or alternative; or
>
> "(D) Mitigation measures or alternatives which are considerably different from those analyzed in the previous EIR would substantially reduce one or more significant effects on the environment, but the project proponents decline to adopt the mitigation measure or alternative."

Guidelines section 15052 requires responsible agencies to assume the role of lead agency if (1) a subsequent EIR is required; (2) the lead agency has granted a final approval for the project; and (3) the statute of limitations for challenging the lead agency's action under CEQA has expired. Additionally, responsible agencies must assume the role of lead agency when "The lead agency has prepared inadequate environmental documents without consulting with the responsible agency as required by [Guidelines] Sections 15072 or 15082, and the statute of limitations has expired for a challenge to the action of the appropriate lead agency." (Guidelines, § 15052; see *id*., § 15096, subd. (e)(3)(4), (f).)

CEQA and the Guidelines require agencies to "avoid or minimize environmental damage where feasible" (Guidelines, § 15021, subd. (a); see §§ 21002.1, 21061, § 21080.5, subd. (d)(3)), using an "interdisciplinary" *natural- and social*-science-based approach. (Guidelines, § 15142; see § 21001.) EIR-level review, or the functional equivalent thereof for state agencies proceeding under a regulatory program certified under § 21080.5, is mandatory if a project "may have a significant effect on the environment." (§§ 21100, subd. (a), 21151, subd. (a).) EIR documents "should be prepared with a sufficient degree of analysis to provide decisionmakers with information which enables them to make a decision which

intelligently takes account of environmental consequences." (Guidelines, § 15151; see *Watsonville Pilots Assn. v. City of Watsonville* (2010) 183 Cal. App.4th 1059, 1080; see *id*. 1086-1087 [CEQA violated because the EIR failed to analyze a reduced development alternative that would have been " 'capable of avoiding or substantially lessening any significant effects of the project,' even if it 'would impede to some degree the attainment of the project objectives' "].) When preparing an EIR, "an agency must use its best efforts to find out and disclose all that it reasonably can[,]" (Guidelines, § 15144), performing "thorough investigation…." (*Id*., § 15145; see *Berkeley Keep Jets Over the Bay Com. v. Board of Port Comrs.* (2001) 91 Cal.App.4th 1344, 1370-1371 [CEQA violated because port agency's response concerning adverse air quality impacts of airport expansion plan on neighboring communities and airport workers fell short of the " 'good faith reasoned analysis' mandated by CEQA for responding to significant conflicting information generated by the public"].)

Importantly, a responsible agency must meet its own responsibilities for complying with CEQA's information disclosure provisions, and -- based on the lead agency's EIR as well as all new information contained in an SEIR or other environmental review document the responsible agency may be required to prepare -- must reach its own conclusions on whether and how to approve a project. (Guidelines, §§ 15020, 15096, subd. (a).) Furthermore, regardless of whether the responsible agency must prepare and circulate an SEIR under § 21166 and Guidelines section 15162 or 15163, it must mitigate or avoid "the direct or indirect environmental effects of *those parts of the project which it decides to carry out,* ***finance****, or approve*." (Guidelines, § 15096, subd. (g)(1), italics and bold characters added.) While the responsible agency's mitigation responsibilities thus do not extend to those parts of a project outside its approval or financing purview, still:

> "[The responsible agency] "shall not approve the project as proposed if [it] finds any feasible alternative or feasible mitigation measures within its powers that would substantially lessen or avoid any significant effect the project would have on the environment." (Guidelines, § 15096, subd. (g)(2).)

As emphasized in *Berkeley Keep Jets Over the Bay Com.*, CEQA calls for written responses to public comments that including significant conflicting information generated therein. CEQA's written response requirement involves two distinct public duties. First, an agency subject to EIR-level review (whether in the form of an EIR or functional equivalent) must "consider" and actually "evaluate" the comments it receives. (§ 21091, subd. (d)(1) & (2)(A); see also § 21080.5, subd. (d)(2)(D).) Second, it must prepare written responses for inclusion in the final EIR, "describ[ing] the disposition of each significant environmental issue that is raised by commenters[,]" consistent with rigorous standards of adequacy set forth in Guidelines section 15088. (§ 21091, subd. (d)(2)(A) & (B); see *Mountain Lion Foundation v. Fish & Game Com.* (1997) 16 Cal.4th 105, 122-123, 133 (*MLF*); *Berkeley Keep Jets Over the Bay Com.,* 91 Cal.App.4th 1344, 1367; *Cleary v. County of Stanislaus* (1981) 118 Cal.App.3d 348, 356.) Evidently, the first requirement is intended to prevent hastily prepared or evasive responses, and to secure factual accuracy and scientific integrity. (See *Berkeley Keep Jets Over the Bay Com.*, 91 Cal.App.4th 1344, 1370-1371 [responses to comments must be supported "by scientific or objective data"].) Without the CEQA mandated good faith

reasoned responsive analysis, reasons for rejecting opposing views in written form cannot be articulated, and "understanding of the significant points raised in opposition" cannot be sharpened. (*MLF*, 16 Cal.4th 105, 122-123.) Thus, "The written response requirement ensures that members of the [agency] will fully consider the information necessary to render decisions that intelligently take into account the environmental consequences. [Citations.]" (*Id*. at 133.) This also promotes CEQA's policy of citizen input. (*Ibid*.)

Furthermore, as part of the environmental review process, state and local agencies must consult with responsible and trustee agencies -- including federal agencies -- and such consultation extends to the scope and substance of an EIR. (§§ 21080.3, 21080.5, subd. (d)(2)(C), 21104, 21153; Guidelines, §§ 15082, 15083, 15086.) Consultation also must be conducted to determine whether or not EIR-level environmental review should be conducted. (Guidelines, § 15063, subd. (g).) The EIR must include environmental information "germane to the statutory responsibilities" of the responsible agencies consulted as specified by the responsible agencies during consultation. (§ 21080.4, subd. (a).) Public agencies, *whether acting as lead or responsible agencies*, may not approve a project for which an EIR was prepared unless either (a) the project will not have a significant effect on the environment; (b) the agency has eliminated or substantially lessened all significant effects on the environment and supported that conclusion with findings in compliance with Guidelines section 15091; or (c) the agency has determined that certain significant effects are unavoidable but acceptable and supported this determination with a statement of overriding considerations in compliance with Guidelines section 15093. (§ 21081; Guidelines, § 15092.) Such agencies must make findings as required by Guidelines section 15091 to support those determinations, and must adopt a mitigation monitoring or reporting program in compliance with section 21081.6. (Guidelines §§ 15091, subd. (d), 15096, subd. (h).) Decisions, determinations and findings to certify an EIR and to adopt a statement of overriding considerations must all find support in substantial evidence. (§§ 21081.5, 21168, 21168.5; Guidelines, § 15091, subd. (b).)

The National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 et seq.) and the Council on Environmental Quality's NEPA Regulations (40 C.F.R. § 1500 et seq.) require a federal agency to prepare an EIS for major federal actions affecting the quality of the human environment. (42 U.S.C. § 4332(2)(C).) In order to assist agencies in determining whether an EIS is necessary, NEPA generally requires the preparation of an environmental assessment (EA) as an initial step unless a categorical exclusion applies. A federal agency may allow a project applicant to prepare an EA for review by the federal agency. (40 C.F.R. § 1506.5(b).) However, if the federal agency allows this, the agency still must "make its own evaluation of the environmental issues and take full responsibility for the scope and content of the [EA]." (*Ibid.*) The EA must provide sufficient evidence and analysis to allow the federal agency to determine whether an EIS is required. (40 C.F.R. § 1508.9.) Specifically, an EA must discuss (1) the need for the proposed action; (2) the probable environmental impacts of the proposed action; (3) alternatives to the proposed action; and (4) agencies and persons consulted during preparation of the EA. (40 C.F.R. § 1508.9(b).)

NEPA contemplates consultation, which it refers to as "scoping." (40 C.F.R. §§ 1501.7, 1508.9 (b).) Also, Section 7 of the Endangered Species Act (16 U.S.C. § 1536(a)(2)), requires all federal agencies to consult

with the National Marine Fisheries Service for marine and anadromus species (such as the steelhead), or the U.S. Fish and Wildlife Services for fresh-water and wildlife, if they propose an "action" that may affect listed species or their designated habitat. "Action" is defined broadly to include funding, permitting and other regulatory actions. (50 CFR §402.02.) For any project that requires a federal permit or receives federal funding, Section 7 consultation serves to insure that any action the federal agency authorizes or funds is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Consultation involves preparation by the state agency proposing the project of a biological assessment (BA) to analyze its potential effects on listed species and critical habitat. Upon review of the BA, the federal agency may find that the project may adversely affect listed species or their habitat, in which case it prepares a "biological opinion" (BiOp).

If, after preparation of an EA, the federal agency determines that a project would not have a significant effect on the human environment, it must prepare a Finding of No Significant Impact (FONSI), which must include an explanation of the reasons for the agency's conclusion. (40 C.F.R. §§ 1501.4(e), 1508.13.) The agency must also make the FONSI available to the public. (40 C.F.R. §§ 1501.4(e)(1), 1506.6(b).) After preparation of an EA, a supplemental EA must be prepared if, either (a) the federal "agency makes substantial changes in the proposed action that are relevant to the environmental concerns; or [¶ (b) There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action[.]" (*Idaho Sporting Congress, Inc. v. Alexander* (9th Cir. 2000) 222 F.3d 562, 566; *id.* at 566, fn. 2.)

The federal Clean Water Act (33 U.S.C. § 1251 et seq.) requires that any application for federal grant funding for "treatment works" (including wastewater treatment/recycling projects) "contain adequate data and analysis demonstrating such proposal to be, over the life of such works, the *most cost efficient alternative*[.]" (33 U.S.C. § 1292(b), italics added.)

USDA regulations applicable to USDA loans require that USDA-funded projects conform to NEPA and provide "the most economical service practicable." (7 C.F.R. § 1780.57(a), (c), (f), (n), (o).) Guidance from the USDA's Rural Utilities Program states that an applicant should, where practicable, consider, among others, alternatives "optimizing the current facilities (no construction) [and] centrally managed small cluster or individual facilities." (USDA Rural Utilities Service, Bulletin 1780-2 (9-10-03) at 4-5.)

Flaws in the LOWWP Review Process and the Approved Project.

The LOWWP and its review process violate CEQA, NEPA, the Clean Water Act and USDA regulations and policies. Substantial new information, including information currently being developed in a revised BiOp revealing new project impacts on the federally endangered Morro shoulderband snail (due to a project change adopted by the California Coastal Commission after certification of the final EIR), as well as changes in relevant environmental conditions, mandate preparation of an SEIR and an EIS (or a combined SEIR/EIS). For the same reasons, and due to environmental information disclosure gaps in the EA

prepared last year for the federally-funded, USDA Rural Utilities Service financial assistance for the project, NEPA also calls for recirculation of a supplemental (or revised) EA.

Violations of CEQA and NEPA

1. Contrary to CEQA and NEPA, neither the EIR nor the EA adequately disclose, address, avoid, minimize or mitigate substantial adverse environmental impacts (including indirect, cumulative, and socio-economic effects) or explain why certain impacts are not being mitigated. (See *Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal.App.3d 692, 712; §§ 21005, 21002.1, subd. (c), 21081, 21081.5; Guidelines, §§ 15003, subd. (i), 15002, subds. (a)(4) & (f), 15144, 15151, 15021, 15091, 15092, 15126.4, 15130, 15131, 15355, 15370; 42 U.S.C. §§ 4332, 4333; 40 C.F.R. §§ 1501.4, 1506.5, 1508.3, 1508.7, 1508.8, 1508.9(b), 1508.13, 1508.14, 1508.20, 1500.21, 1500.24, 1508.27.)

    - <u>Significant new seawater intrusion and freshwater salinization impacts in the Los Osos groundwater basin.</u> The EIR and the later EA do not adequately estimate or forecast the substantially adverse direct, indirect and cumulative environmental impacts on fresh groundwater storage and the coastal ecosystem, caused by seawater intrusion in the groundwater basin. This is so because when those environmental documents were prepared and finalized, the severity of the movement and extent of saline water into the basin was not known. Nor could it have been known: in May 2010 (eight months after the final EIR was certified), new baseline information emerged, based on seawater intrusion monitoring in the lower basin, conducted in December 2009 and January 2010 under the auspices of an interagency working group. This information is significant for it shows previously unknown, severe acceleration of seawater intrusion in the groundwater basin.[2] In May 2010, seawater intrusion was found to be moving 12 times faster than the EIR predicted, threatening to shut down major supply wells. (Attachment 2, exh. B; Attachment 3, at 1.)[3] According to the results of the current monitoring, seawater intrusion moved

[2] The interagency working group which developed the new information, known as the interlocutory stipulated judgment or "ISJ" working group, was established in adjudicative proceedings over basin water rights. The ISJ working group consists of representatives from the County of San Luis Obispo and the area's three major water purveyors. This working group released the new information in a report dated May 4, 2010, entitled "Los Osos Groundwater Basin Update." (Attachment 2.)

The ISJ working group is charged with preparing a groundwater basin management plan. The December 2009 and January 2010 seawater intrusion monitoring was conducted "to update estimates of the rate and extent of seawater intrusion" in the lower aquifer zones that are used for groundwater production. (Attachment 2, at 3.)

[3] Because saltwater has high concentrations of total dissolved solids and inorganic constituents, it is unfit for human consumption and other anthropogenic uses. It will force abandonment of the supply wells when concentrations of dissolved ions exceed drinking water standards.

between 2005 and 2010 700 feet per year, a half-mile in four years, through the large lower aquifers. In contrast, the final EIR for the LOWWP used a maximum estimated average annual rate of intrusion of 60 feet per year. Being based on outdated seawater intrusion data, the mitigation measures adopted as part of the approval of the LOWWP fail to avoid, minimize or mitigate the actual impacts of seawater intrusion. They fail to account for the rapidly accelerating seawater intrusion. Nor do they account for substantial uncertainties in basin modeling (Attachment 4, Attachment 10, at 4; Attachment 24, at 5); significantly reduced recharge/mitigation at the Broderson leach fields for two years as the leach fields are being tested; non-existent recharge/mitigation if the Broderson leach fields do not perform (Attachment 20, at 6; Attachment 33); a modified recycled water program that will not mitigate for adverse impacts on seawater intrusion and habitat at the same time, and may not be viable due to high salt content in the wastewater stream (Attachment 3, at 2; Attachment 25, at 10; Attachment 33, at 4); and certain project conditions (No. 97 and No. 99) for reuse and conservation.[4] The current mitigation for the adverse impacts of aquifer contamination due to seawater intrusion is inadequate, potentially infeasible and not fully funded. As designed and mitigated, the LOWWP is likely to do more harm than good to the basin. Indirect, public health and socio-economic effects from loss of the potable water resource, and those effects' own adverse impacts on the environment, must be considered before committing tens of millions of dollars of public funding to the LOWWP. CEQA and NEPA preclude responsible agency funding for the LOWWP without public environmental review of (1) the significantly increased saltwater movement into the basin -- a major change in physical baseline conditions affecting groundwater sustainability;[5] and (2) the relationship of this change to the changes in aquifer dynamics and freshwater storage that result from the implementation of the LOWWP, as designed and approved, including the attendant decommissioning of all onsite wastewater disposal systems. Environmental assessment crucial to informed decisionmaking on the seawater intrusion impacts of the LOWWP and the comparative impacts of feasible wastewater treatment alternatives must be performed, and mitigation measures correlated to the actual

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[4] Those conditions do not minimize impacts on seawater intrusion, and they are unenforceable. (Attachment 3, at 1-2; Attachment 4, at 2; Attachment 25, at 14-16; Attachment 33.) Condition No. 99, for instance, requires an indoor conservation program that is not enforceable, while providing only half the mitigation of an indoor-outdoor program. The reason an indoor conservation program is not enforceable is that water use is measured at the meter, and the meter does not differentiate between indoor and outdoor uses. What this means is that the County cannot be held to a measureable standard. Also, the County makes the patently absurd assumption that during two winter months in this coastal area there will be no outdoor use. Similarly, according to Condition No. 97, the recycled water program relies on the Broderson leach fields, which -- if the leach fields perform at all -- will provide less than half the mitigation options recommended by the Los Osos Sustainability Group would provide. (Attachment 25, at 10.)

[5] The basic scientific premise that seawater intrusion reduces the basin's fresh groundwater storage capacity is accepted by all affected stakeholders.

severity of the impact (the real, anticipated salinity levels and their distribution) must be developed and implemented, based on specific, measurable, enforceable and verifiable performance standards.

- Significant impacts on environmentally sensitive habitat, including habitat of national significance. Neither the EIR nor the EA adequately analyze, avoid, minimize or mitigate significant impacts on environmentally sensitive habitat, namely (1) the Willow Creek Drainage; (2) Los Osos Creek (protected steelhead habitat); and (3) wetlands, springs and marshes along Morro Bay National Estuary-State Marine Reserve, which are an integral part of the estuarine system. (Attachment 20, at 1, 4, 5, 9-13; Attachment 24, at 4, Attachment 41, at 20-29.) Relevant environmental assessments to assess resource impacts were deferred (including groundwater flow measurements) and specific, measurable and enforceable mitigation measures, such as mechanisms and water sources to restore flows, remain to be identified to address potential reduction of "several hundred acre feet" of groundwater flows. (Attachment 20, at 1; Attachment 25, at 2; Attachment 33; Attachment 41, at 23.) The LOWWP predecessor project (not built) mitigated these impacts with multiple leach fields and harvest wells. (See Attachment 35, at 1-3.) These are not included because they are considered a groundwater recharge program (GRRP) requiring higher levels of treatment (e.g., reverse osmosis). The feasibility of these measures has not been considered and they are not funded. (Attachment 43; Guidelines, § 15126.4, subd. (a)(1).)

- Significant cumulative impacts. Substantial changes in pumping patterns are currently planned by purveyors in the face of the rapid increase in seawater intrusion. The purveyor plan (which involves shifts in pumping, nitrate treatment of upper aquifer water and desalination) is due to be released in March of 2011. Neither the EIR nor the EA analyze, avoid, minimize or mitigate the cumulative effects on the basin (upper aquifer and eastern portions of the groundwater basin in the urban area) resulting from the LOWWP in combination with the reasonably foreseeable changes associated with the purveyor plan. Eugene Yates, a respected hydrogeologist, has pointed out that the LOWWP, in combination with the now-planned increased pumping from the upper aquifer, may allow seawater to intrude into the *upper* aquifer -- thereby exacerbating an already severe, previously seriously underestimated water quality impact. Yates urges environmental review of the previously unknown cumulative effect and recommends increased mitigation. (Attachment 3, at 1-4, 7.)[6] The public, especially the residents and local businesses dependent on the groundwater supply must be given an opportunity to offer comment on

[6] A peer review of the basin model included in the Basin Update released by the water purveyors on May 4, 2010, suggests purveyor changes will not cause impacts. However, the update does not consider accelerating seawater intrusion or a review of the model by Yates -- one of the model's creators. (Attachment 2, exh. C; Attachment 3, at 1-2; Attachment 24.)

those new circumstances and increased jeopardy to the sustainability of the basin, in the manner required by CEQA and NEPA.

- Socio-economic effects. The funding decisions to be made must also be preceded by environmental review of their socio-economic impacts, and the indirect environmental effects of those impacts. And they must address measures to prevent those impacts. The estimated monthly cost of the project (optimistically assuming no construction overruns) is $189-$377 per single family homeowner. (Attachment 27, at 1.) Steeply rising water costs from planned changes in purveyor basin management measures (e.g., treating water for nitrates and desalination) will push monthly sewer/water costs to $400-$500 (and higher) for many households. (Attachment 2, at 5-6; Attachment 27, at 1-2.) This will cause severe financial hardship for most people in the Los Osos community. *Thirty-three percent (33%) of residents collect Social Security (an indicator of the number of people on fixed incomes), which is 50% above the state average.* For at least 25% of homeowners, water and sewer costs will be well over 10% of household incomes. Many households will be unable to sustain the costs and will have to relocate. (Attachment 27, at F-G.) Excessive water-sewer costs will destroy home values and the equity families have in their homes, potentially forcing families into foreclosure. This will result in an economically depressed area, with many homes left empty or in disrepair. Businesses and local tax revenue will be harmed as jobs will be lost. This will cause adverse impacts on the environment since homeowners will be unable or unwilling to pay future project costs, including (1) the unfunded mitigations identified above; (2) construction overruns; (3) unfunded maintenance costs; and (4) emergency repairs due to damage caused by, among other things, earthquake and storm damage. Since sewer and water costs are tied to water use, outdoor watering will be curtailed, deteriorating community aesthetics while causing landscaping to dry up. This, in turn, will adversely impact quality of life in the area, tourism, local businesses and employment. Very low water use may also cause blockages in the LOWWP's proposed conventional sewer system, overflows, and contamination of homes and surface waters. Such problems will result in higher-than-budgeted sewer maintenance costs and additional water use (to flush the system), further depleting short supplies. The adverse cumulative effects will increase underfunding of project costs and reduce repairs and reduce available water for habitat. With rapidly worsening seawater intrusion, a spiral of more severe consequences may result, including (1) severe water shortages and rationing; (2) a non-viable recycled water program due to high salt content in the water supply; (3) permanent harm to environmentally sensitive wildlife habitat; (4) shutdowns of water and wastewater services; (5) environmentally damaging emergency projects to supply water (trucked-in water, desalination and pipeline projects); and (6) exodus of people from the Los Osos community. (Attachment 36.) Reasonably foreseeable, short- or long-term indirect effects on the environment, associated with the LOWWP, its costs and its cumulative effects must not be divorced from environmental review. (See Guidelines, § 15126.2, subd. (a).) In particular, economic or social changes

must be identified to the extent necessary to trace the chain of (socio-economic) cause and (environmental) effect. (Guidelines, § 15131, subd. (a); 40 C.F.R. §§ 1508.8, 1508.14.) Also, "Economic, social, and particularly housing factors shall be considered by public agencies together with technological and environmental factors in deciding whether changes in a project are feasible to reduce or avoid the significant effects on the environment identified in the EIR." (Guidelines, § 15131, subd. (c).)

- Significant growth inducing impacts. The project will induce growth for two main reasons. First, it is oversized. The Coastal Development Permit (CDP) states that wastewater flows will be 700 acre-feet per year (AFY) -- 625,000 gallons per day (gpd) -- at project start up. However, at full build out, the project will have a capacity of 1,233 AFY (1,100,000 gpd). This amounts to 533 AFY more capacity than needed for the current population, *and 300 AFY more than needed for the build out population*. (Attachment 25, at 9.) Because the basin now has a critical seawater intrusion problem, the substantial excess capacity built into the system is unwarranted. The water management plan the water purveyors are preparing, due in March 2011, cannot and should not be assumed to balance the basin and reverse seawater intrusion while also providing enough additional water for growth. Prudent basin safe yields assumptions must account for substantial margins of safety. Hydrogeologist Eugene Yates found that shifts in pumping won't increase basin yields. (Attachment 3, at 1; Attachment 24, at 4.) Mr. Yates and Dr. Douglas Smith, another expert, have shown that basin yield estimates have considerable uncertainty requiring substantial margins of safety and intensive conservation to correct the imbalance and avoid permanent loss of basin capacity. (Attachment 3, at 7; Attachment 4, at 2; Attachment 24, at 5.) The project also promotes unsustainable growth by tying reductions in project costs to future development. A rates and charges ordinance approved by the County in December 2010 includes $27 million in project capital costs that were supposed to be paid by the owners of undeveloped properties. (Attachment 13, at 4.) However, due to the serious resource deficiency caused by seawater intrusion, County officials realize undeveloped property owners will not approve an assessment. Nevertheless, County officials and a flier sent to homeowners indicate sewer costs will go down when undeveloped properties are developed. (Attachment 13, at 4; Attachment 27, at B; Attachment 28, at 9, 10.) This linking of reduced sewer costs to development will drive future planning (the purveyor management plan and Local Coastal Plan Update), even though substantial, undisputed evidence in the public record (a long history of basin overdraft and seawater intrusion) supports the conclusion that the basin has reached or exceeded its carrying capacity for the current population and land uses. Additionally, supplemental water supplies (imported water and desalination) will be economically infeasible, and will have their own adverse environmental impacts. The oversized project, high costs and funding strategies promote unsustainable growth and, as a result, indirect and cumulative environmental impacts, including those discussed above.

- Significant impacts due to "hybrid" conventional gravity collection system. The proposed conventional gravity collection system, even with proposed upgrades, will have substantial adverse impacts that are not mitigated and could be avoided with a different system. The CDP application (at page 58) identifies 336 AFY (300,000 gpd) of the wastewater flows as "Inflow and Infiltration" (surface or groundwater water entering the system). (Attachment 25, at 9.) High levels of inflow and infiltration into a wastewater system is the leading cause of harmful overflows. (Attachment 39, at 3.) The gravity system is prone to this problem and while the septic tank effluent pumping (STEP) system is not. Review documents indicate the proposed alternative will have average flows 200 AFY greater than STEP system. (Attachment 21, at 4.) The June 8, 2010 CDP Application Addendum (at page 2) alleges that the proposed collection system is a "sealed system [that is] not anticipated to leak under appropriate installation practices." (Attachment 25, at 19.) This allegation is one example of how the review process has been biased toward the proposed conventional gravity system, i.e., by underestimating the potential for inflow and infiltration, and adverse impacts thereof on groundwater, surface waters and other resources. (Attachment 39, at 3; Attachments 11, 40.) High inflow and infiltration increases energy use, chemical use, GHG emissions, and operation and management costs due to wear and tear on the system and the need to pump and treat higher volumes of wastewater. Even with some of the proposed system chemically sealed (it is supposed to be sealed only in high groundwater areas), inflow and infiltration along with related adverse impacts will be considerably greater than for fully sealed "small-pipe" systems. Furthermore, sealing the system adds to costs relative to STEP, septic tank effluent gravity (STEG) and other "small-pipe" sealed systems (e.g., decentralized and vacuum). (Attachment 21, at 2-4.) Sections of the proposed collection system that are not chemically sealed are vulnerable to inflow from surface runoff and exfiltration (leakage of raw sewage out of the system). (Attachment 39, at 2, 3; Attachment 40.) Exfiltration can go unnoticed and leaks can be economically infeasible to repair in "large pipe" systems, thus giving rise to long-term groundwater pollution impacts. (Attachments 8, 11; see also the discussion of geotechnical impacts next.)

- Significant seismic and ground movement impacts. Los Osos is in a earthquake zone and liquefaction zone. The EIR has deferred assessment of the potentially significant adverse impacts of ground movement on the project, including its collection system. (Attachment 37.) The adverse effects of a major earthquake, and even a moderate one, on the gravity collection system may be severe, even catastrophic, rendering parts of the system or the entire system unusable pending difficult and costly repairs. Blockages of the system due to disconnected, misaligned or collapsed pipes will cause backups and overflows, adversely impacting human health, water supplies (ground and surface) and ecosystem function. Given the very high costs of the proposed system and its severe socio-economic repercussions, earthquake repairs may be deferred and underfunded, if feasible at all.

Alternative systems (see below) would avoid or, at a minimum, substantially lessen these adverse impacts.

2. The review process has failed, and continues to fail, to consider a reasonable range of feasible or potentially feasible project alternatives -- including the most cost-effective wastewater treatment alternative, or to provide an objective, accurate and adequate analysis of alternatives. (See *Laurel Heights Improvement Assn. v. Regents of the University of California* (1988) 47 Cal.3d 376, 399-407; *Kings County Farm Bureau*, 221 Cal.App.3d 692, 730-737; §§ 21002, 21081, subd. (a)(1), 21081.5, 21100, subd. (b)(4); Guidelines, §§ 15021, subd. (a)(2), 15091, 15092, subd. (b)(2)(A), 15126, subd. (f), 15126.6; 42 U.S.C. §§ 4332(2)(C)(iii) & (E), 4334; 40 C.F.R. §§ 1505.1(e), 1507.2(d).)

   - <u>A decentralized project with two treatment sites.</u> The EIR rejected this alternative as infeasible due to high cost and potential impacts to local environmentally sensitive habitat . However, with treatment sites at the north end of the Mid-town site (on acquired, already-disturbed land) and at the project staging site for the previous project (already disturbed), combined with Los Osos Sustainable Group (LOSG) Sustainable Basin Plan recommendations (which eliminated drain fields in the community), the alternative may reverse seawater intrusion and have significantly greater environmental benefits than the LOWWP. The benefits include (1) greater water quality improvements; (2) substantially lower energy costs and GHG emissions; (3) greater protection of coastal zone environmentally sensitive habitat areas (ESHAs); (4) more quality of life/community aesthetics features; and (5) lower costs -- about $35 million less than the LOWWP ($145 million vs. $180-$190 million). (Attachment 3, at 7; Attachment 8, at 2; Attachment 7, at 4-10; Attachment 10, at 1-3; Attachments 4, 5, 6, 15.)

   - <u>A decentralized project with a mix of on-site and cluster systems.</u> USDA policy specifically recommends consideration of this alternative, yet was not reviewed. Combined with the LOSG Sustainable Basin Plan recommendations, it may or would (1) reverse seawater intrusion; (2) reduce ground and surface water contamination (from all sources); (3) greatly reduce energy costs and GHG emissions; and (4) virtually eliminate threats to the basin and ESHA from altered/reduced groundwater flows -- all for about half the cost of the LOWWP ($85 million vs. $189 million). This cost-effective alternative would require amendments to the septic tank prohibition. These are within the discretion of the CCRWQCB -- which adopted the prohibition, and is a responsible and trustee agency concerning the LOWWP. (Attachment 3, at 7; Attachment 8, at 3-4; Attachment 7, at 9-10; Attachment 10, at 1-3; Attachment 15, at 1-3; Attachments 4, 5, 6, 9.)

   - <u>A centralized STEP project with objective, accurate assumptions.</u> The EIR evaluated this alternative but found it to be environmentally inferior to the LOWWP. This EIR finding was unsupported by substantial evidence. It was derived from biased assumptions and inaccurate information. Compared to the LOWWP, this alternative would reduce

environmental impacts (due to less inflow and infiltration, the leading cause of sewage overflows) while accommodating conservation flows without redesign or added costs. It could be constructed much faster, and would be far less vulnerable to damage caused by earthquakes and liquefaction. And, in the event of an earthquake, repair costs would be far lower -- $20 million to $50 million less than the LOWWP. (Attachment 8, at 1; Attachment 12, at 2; Attachment 15, at 1-4; Attachment 21, at 1; Attachments 11, 16.)

- Optimizing the Current System. USDA policy specifically recommends consideration of this alternative, but the EIR did not consider it. Combined with the LOSG Sustainable Basin Plan recommendations for basin-wide water use efficiency and septic system, nitrate and stormwater management programs, this alternative may reverse seawater intrusion, significantly reduce nitrates and other forms of contamination, while also addressing concerns relating to septic systems located in high groundwater areas and near the estuary (by lowering groundwater levels and ensuring alternative maintenance systems). (Attachment 3, at 4; Attachments 4, 5, 6.) This alternative would achieve most of the project objectives at a fraction of the cost of the proposed project, while eliminating all significant adverse impacts of the project. Water use efficiency, septic system and nitrate management plans were never implemented in the basin.

3. Significant new information exists, calling for an SEIR for purposes of state responsible agency review; and an EIS (or, preliminarily, a supplemental EA) for purposes of federal agency review. (§ 21166; Guidelines, §§ 15162, 15163; see also *id*., 15088.5, 15052, 15096; *Idaho Sporting Congress, Inc. v. Alexander* (9th Cir. 2000) 222 F.3d 562, 566; *id.* at 566, fn. 2 [noting that 40 C.F.R. § 1502.9 is the standard for the duty to supplement *both* EISs and EAs].)

- As emphasized at pages 6 through 8, above, in May 2010, the ISJ working group released the Basin Update, which revealed a substantial change in basin conditions -- far more rapidly accelerating seawater intrusion in the Los Osos Valley Basin than was previously known. (Attachment 2, exh. B.) The Basin Update showed the basin model -- the same one used to predict the LOWPP's adverse impacts on seawater intrusion -- is not reliable for estimating seawater intrusion, project effects thereon -- and hence on drinking water quality -- or the adequacy of the Broderson leach fields as mitigation for this significant impact. The Basin Update includes a peer review of the basin model that did not consider the accelerating seawater intrusion or two reviews of the basin by Mr. Yates who co-authored two basin studies. (Attachment 24, at 1, 2; Attachment 3.) The peer review recommends model upgrades to express uncertainty values and clarify data input. (Attachment 2, exh. C, at 9.) The Basin Update also indicates that water purveyors are considering desalination, nitrate treatment for the upper aquifer and other options that may have adverse environmental affects in combination with the LOWWP, and substantially undermine the need for the LOWWP. (Attachment 2, at 5-6.) Treatment of nitrates at the well head and desalination now are considered feasible mitigations or alternatives that

could substantially reduce or avoid project impacts by reducing or removing the need for implementing the centralized conventional-gravity waste water treatment option the LOWWP represents. CEQA and NEPA require the alternatives to re-evaluated in a SEIR or EIS (or supplemental EA), given the new information now available, and its significance in negating EIR- and EA-based assumptions.

- In his June 2010 review of the Basin Update, considering the factual data contained therein, Mr. Yates opined that accelerating seawater intrusion into the basin is an "extremely urgent" problem requiring urgent action, including 500 AFY of reduced pumping from the urban compartment. (This is consistent with the water-use efficiency plan recommended by the Los Osos Sustainability Group). (Attachment 3, at 1, 3, 7; Attachment 5.) Yates also recommended the review of a wider range of mitigation options to address changes in basin conditions, adding that the project, in conjunction with the increased pumping from the upper aquifer may induce seawater intrusion in the *upper* aquifer. (Attachment 3, at 1, 2, 4-7.) Yates explained that accelerating seawater intrusion may make the LOWWP's recycled water reuse program -- viewed as key mitigation for the LOWWP -- less viable. (Attachment 3, at 2.) Finally, he reiterated the need (noted in his January 13 review) to account for substantial uncertainties in modeling, with margins of safety built into measures, including "proactive" conservation. (Attachment 3, at 1, 7; Attachment 24, at 4, 5.)

- In January 2010, after reviewing basin modeling submitted to the Coastal Commission for its CDP review, Mr. Yates found that the EIR overlooked impacts on wetlands and other sensitive habitat along the estuary and Willow Creek Drainage, and that the Broderson leach fields will not mitigate for these impacts, as assumed by the EIR. Yates also cautioned that the modeling has substantial uncertainties, casting considerable doubt on the adequacy of EIR mitigation measures. He indicated the need for substantial margins of safety. (Attachment 24, at 4-5.) This post EIR expert review and the findings it yielded have yet to be considered by responsible agencies and factored into their post EIR environmental review process and decisionmaking. (Attachment 25.)

- In March 2010, water quality testing for Morro Bay Estuary conducted by the National Estuary Program (NEP) and the San Luis Obispo Science and Ecosystems Alliance (SLOSEA) indicated that nitrate levels remain very low in the estuary, and fecal coliform levels are well within safe limits, and are possibly declining. These data provide substantial evidence that septic systems are not harming estuary water quality and do not pose a threat to the basin or human health. (Attachment 23.) The CDP and other project documents cite a 16-year old (1995) Regional Water Quality Control Board "preliminary working draft" for the proposition that septic systems are harming the estuary and habitat. But this preliminary draft does not establish that septic systems are the cause of cited

problems (restrictions on shell fish harvesting). (Attachment 25, at 5, 6.) The "draft" report does not constitute substantial evidence.

- In April 2010, the U.S. Environmental Protection Agency (EPA) released its Chesapeake Bay guidelines for septic systems, which allow septic systems to remain in place near Chesapeake (a water body with known nitrate problems). It set discharge requirements based on proximity to the Bay. This reflects *current* EPA policy regarding use of onsite wastewater disposal systems in proximity to a sensitive water body adversely affected by nitrates. Available evidence shows that Morro Bay Estuary is not adversely affected. EPA provides examples of onsite systems and costs, which indicate that substantial reductions in nitrates in the basin can be achieved with onsite systems and system upgrades at per-unit costs substantially lower the LOWWP (approximately $36,000 per single family home). (Attachment 31, 3-5, 17-22.) The report also shows that a Nitrex underground treatment system (the same technology presented in the LOWWP decentralized technical memo for the LOWWP) can reduce nitrates to levels lower than predicted for the LOWWP. (Attachment 31, at 18; Attachments 7, 8, 9.) This new information is significant in that it shows that onsite wastewater disposal and treatment systems present a feasible alternative. As such, it must be accounted for prior to any funding or other discretionary responsible agency decisions concerning the LOWWP.

- In May 2010, a Stanford study established that pathogens from septic systems do not threaten surface water bodies if systems are functioning properly -- which can be monitored. (See Attachment 42, <http://www.stanford.edu/group/knowledgebase/cgi-bin/2010/09/10/from-septic-system-to-the-sea-tracking-groundwater-pollution> [as of Feb. 25, 2011].) This new study, too, is significant, in that it shows that onsite wastewater disposal and treatment systems present a feasible alternative. As such, again, it must be accounted for prior to any funding or other discretionary responsible agency decisions concerning the LOWWP.

- In June 2010, a Water Environment Research Foundation (WERF) study found that GHG emissions from septic tanks (including STEP tanks) are half as high as was assumed in the EIR. This shows a significant reduction of the estimated climate change effects of the centralized STEP and decentralized LOWWP alternatives, not to mention of the effects of existing septic systems. (Attachment 30.)

- In July 2010, the SWRCB published its proposed AB 885 statewide septic system waiver, providing further evidence that septic systems do not require pumping every five years. (Attachment 17.) GHG emissions and other impact estimates for the STEP alternative were based on the assumption that AB 885 would require septic tanks to be pumped every

five years. This inaccurate assumption almost doubles some of the cost and impact estimates for the STEP project (i.e., hauling and handling of septage). (Attachment 16.) The waiver now recognizes that pathogens are not a threat to water bodies if systems are properly functioning, and it sets septic system discharge requirements based on proximity to protected water bodies.

- In August 2010 (in an update of his June review), Mr. Yates confirmed that the Broderson leach fields can be replaced with adequate conservation and additional recycled water storage. (Attachment 3, at 5; Attachment 5.) This would substantially reduce adverse impacts by avoiding the destruction of eight acres of ESHA and the considerable energy use and air pollution impacts caused by the construction and operation of the Broderson leach fields (e.g., significant greenhouse gas emissions related to pumping water uphill to the Broderson leach fields and by rehabilitating (re-excavating and disking) leach fields every five to seven years). (Attachment 15, at 3, 4; Attachment 20, at 6.)

- In December 2010, the San Luis Obispo Board of Supervisors approved a rates and charges Proposition 218 assessment and ordinance that raised the cost of the project for existing homeowners by about $42 million (from $127 million to $169 million, not counting on-lot costs of about $14 million). (Attachment 27, at B, C, F, G; Attachment 21, at 10; Attachment 28, at 8-10; Attachment 13, at 4.) Because the indirect environmental effects of this substantial increase in the project's adverse socio-economic impacts thus could not have been known when the final EIR was certified, they must be addressed through responsible agency supplemental environmental review.

Inconsistency with USDA regulations and policies

1. The EA is not consistent with 7 C.F.R. § 1780.57 (a) (c) (f):

    - The EA does not conform with this regulation governing the construction of USDA funded projects because the project/process (1) does not comply with NEPA; (2) "[f]acility design" does not "consider cost effective energy-efficient and environmentally sound products and services[;]" (3) the design does not prevent water losses and waste (it will result in considerable inflow and infiltration depleting scarce water supplies); and (4) the facility's design does not "provide the most economical service practicable."

2. The EA is not consistent with USDA Rural Utilities Bulletin 1780-2:

    - The EA does not conform to this policy because it does not consider among others, alternatives "optimizing the current facilities (no construction) [and] centrally managed small cluster or individual facilities." (USDA Rural Utilities Service, Bulletin 1780-2 (9-10-

03) at 4-5.)Furthermore, contrary to this guidance document's suggestion, mitigation measures necessary to avoid or minimize any adverse environmental effects are not integrated into project design. (*Id.* at 5.)

Inconsistency with the federal Clean Water Act

1. The EA is not consistent with 33 U.S.C. § 1292:

   - The EA is not consistent with this section because it does not conform to the following provision:

     Any application for construction grants which includes wholly or in part such methods or systems shall, in accordance with guidelines published by the Administrator pursuant to subparagraph (C) of this paragraph, contain adequate data and analysis demonstrating such proposal to be, over the life of such works, the most cost efficient alternative to comply with sections 1311 or 1312 of this title, or the requirements of section 1281 of this title.

XII. LOS OSOS VALLEY GROUND WATER BASIN

Introduction

The Los Osos Valley ground water basin is located within the Los Osos Valley hydrologic basin (Figure XII-1). This wedge-shaped, coastal basin is bordered by two parallel ranges of low-lying hills: the Irish Hills on the south and the Park Ridge Hills on the north. This basin services the communities of Los Osos and Baywood Park.

Historically, the Los Osos and Baywood Park areas have been used for grazing and farming activities. In the late 1950's, the area west of Los Osos Creek began major development. Between 1970 and 1980, intense development occurred and the population of this area increased by over 200 percent (Brown & Caldwell, 1983).

Nitrate Concentrations in the Los Osos Valley Ground Water Basin

Together the basin's two main aquifer zones (Old Dune Sand Deposits and Paso Robles Formation) form a wedge approximately 900 feet deep at the western basin boundary with the depth decreasing to less than 100 feet at the eastern ground water basin boundary. Figure XII-1 indicates the locations of two cross-sections, A1-A2 and B1-B2. These cross-sections, shown in Figures XII-2a and XII-2b, depict the approximate geology of the two main water bearing zones (Brown & Caldwell, 1983; USGS, 1988).

In the upper aquifer, the Old Dune Sand Deposits form a cap overlying the western portion of the ground water basin. These sediments average approximately 100 feet in thickness and extend eastward from Morro Bay toward Los Osos Creek. (The Old Dune Sand Deposits are represented in Figures XII-2a and XII-2b by the "Qso" symbol.)

The lower aquifer extends from Morro Bay to east of Los Osos Creek where it outcrops as shown on Figure XII-2a. For the purposes of this report, the Alluvial Deposits, along with the Paso Robles Formation and the Careaga Sand Formation, are considered the lower aquifer. (In Figures XII-2a and XII-2b, the Alluvial Deposits are represented by the "Qal" symbol, the Paso Robles Formation is represented by the "Qpr" symbol, and the Careaga Sand Formation is represented by the "Qca" symbol.) The thickness of this aquifer at the western boundary is approximately 700 feet, reducing to a thickness of approximately 100 feet at the eastern basin boundary. Recent Alluvial Deposits lie east of Los Osos Creek.

Nitrate contour maps represented in Figures XII-3 to XII-8 are analyzed in this section. The analysis is broken up into a discussion of the two main aquifer zones. Each aquifer is portrayed in three different time periods.

Several wells were not included in the contour maps. These wells were not included because: (1) no perforation data was available to identify the aquifer represented, (2) the well was outside the ground water boundary, or (3) only one data value represented the concentration. Wells with limited perforation data were not mapped because it was not possible to determine which aquifer was perforated. Likewise, some wells had only one nitrate reading for a particular mapped time interval. If the well concentration was high, the mapping program would portray this reading as the center of a plume with a high value. Therefore, single high readings were not placed into the mapping program. An explanation of the reason for not including particular wells is provided in Appendix H-4.

Old Dune Sand Aquifer (Upper Aquifer)

Figures XII-3, XII-4, and XII-5 represent the nitrate concentration contours for the Old Dune Sand Aquifer for three time periods between 1954 to 1994. Looking at the three maps in succession, the nitrate concentrations seem to increase with time. The oldest time period, Figure XII-3, representing data from 1954 to 1973, shows little nitrate contamination. Two plumes with an average high concentration of 20 mg/l nitrate, as NO3, exist.

From 1974 to 1984, data indicate an increase in nitrate concentrations (Figure XII-4). A nitrate plume in the western region of the basin had a maximum average concentration of 60 mg/l nitrate, as NO3. Another plume near the center of Baywood Park shows a maximum average concentration of 45 mg/l nitrate, as NO3.

The most recent map, Figure XII-5, shows three regions within this aquifer with high concentrations. One is located near well number 21 with a maximum average concentration of 75 mg/l nitrate, as NO3. Another is located near well number 38 with a maximum average nitrate concentration of 60 mg/l nitrate, as NO3. The third area has a maximum average concentration of 45 mg/l nitrate, as NO3, centered around well number 79.

Both well numbers 21 and 79 have adequate data to establish a water quality trend. However, well number 38 has only two sampling events for this time frame; both occurred in 1987. Sampling is necessary to validate recent water quality trends.

Two other wells which require additional monitoring are well numbers 20 and 76. Well number 20 has eight monitoring data between 1974 and 1978; no further sampling occurred after 1978. Well number 76 has only two sampling events for the 1985 to 1994 time period; both occurred in 1987.

Paso Robles Aquifer (Lower Aquifer)

Figures XII-6, XII-7, and XII-8 represent the nitrate contours for the Paso Robles Formation, the Careaga Formation, and the Alluvial Deposit east of Los Osos Creek (referred to as the Paso Robles Aquifer in this report). The nitrate contamination problem for the Paso Robles Aquifer is not as severe as the problem encountered in the Old Dune Sand Aquifer.

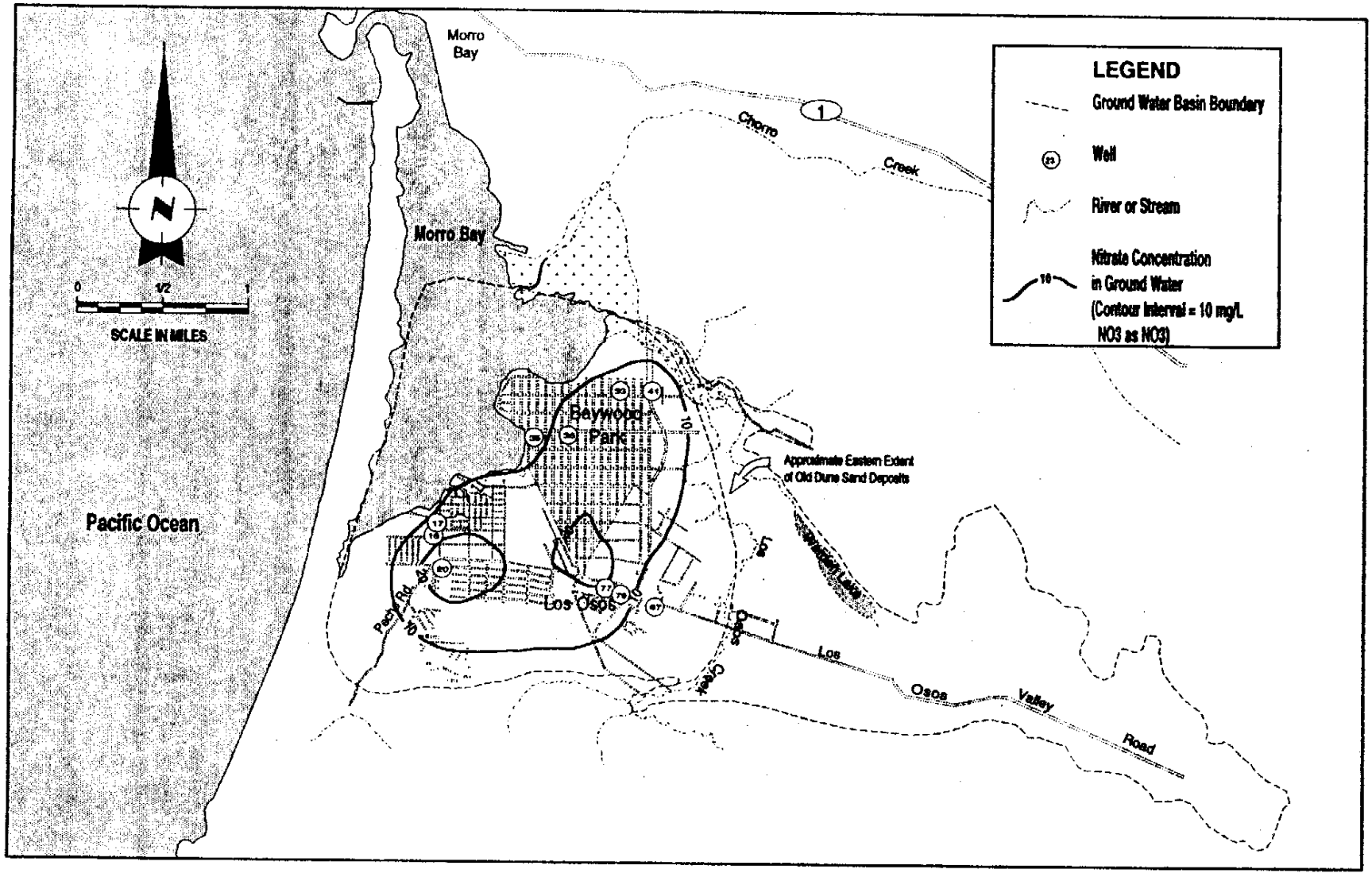

Figure XII-3. Average Nitrate Levels in the Old Dune Sand Aquifer of the Los Osos Valley Ground Water Basin from 1954 to 1973

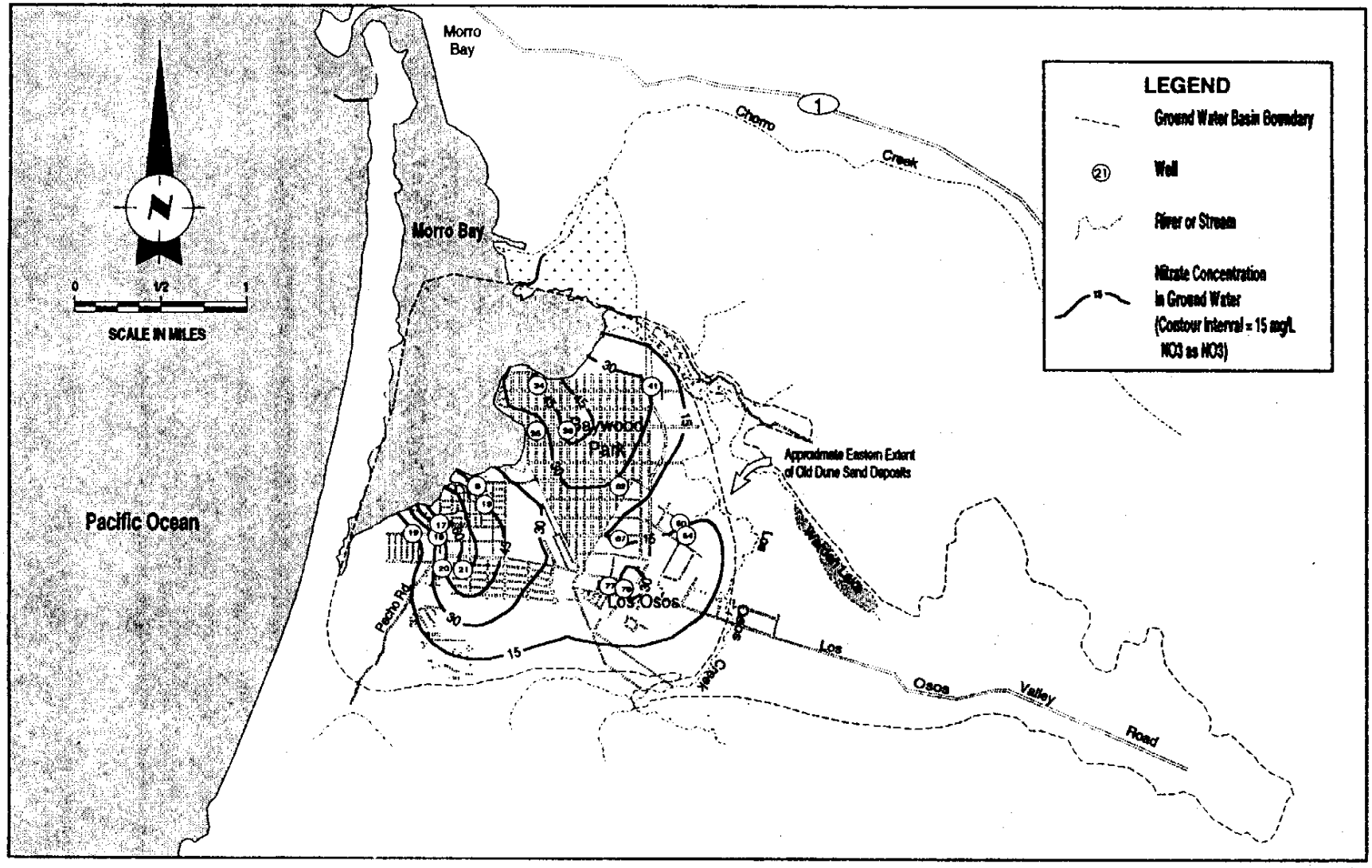

Figure XII-4. Average Nitrate Levels in the Old Dune Sand Aquifer of the Los Osos Valley Ground Water Basin from 1974 to 1984

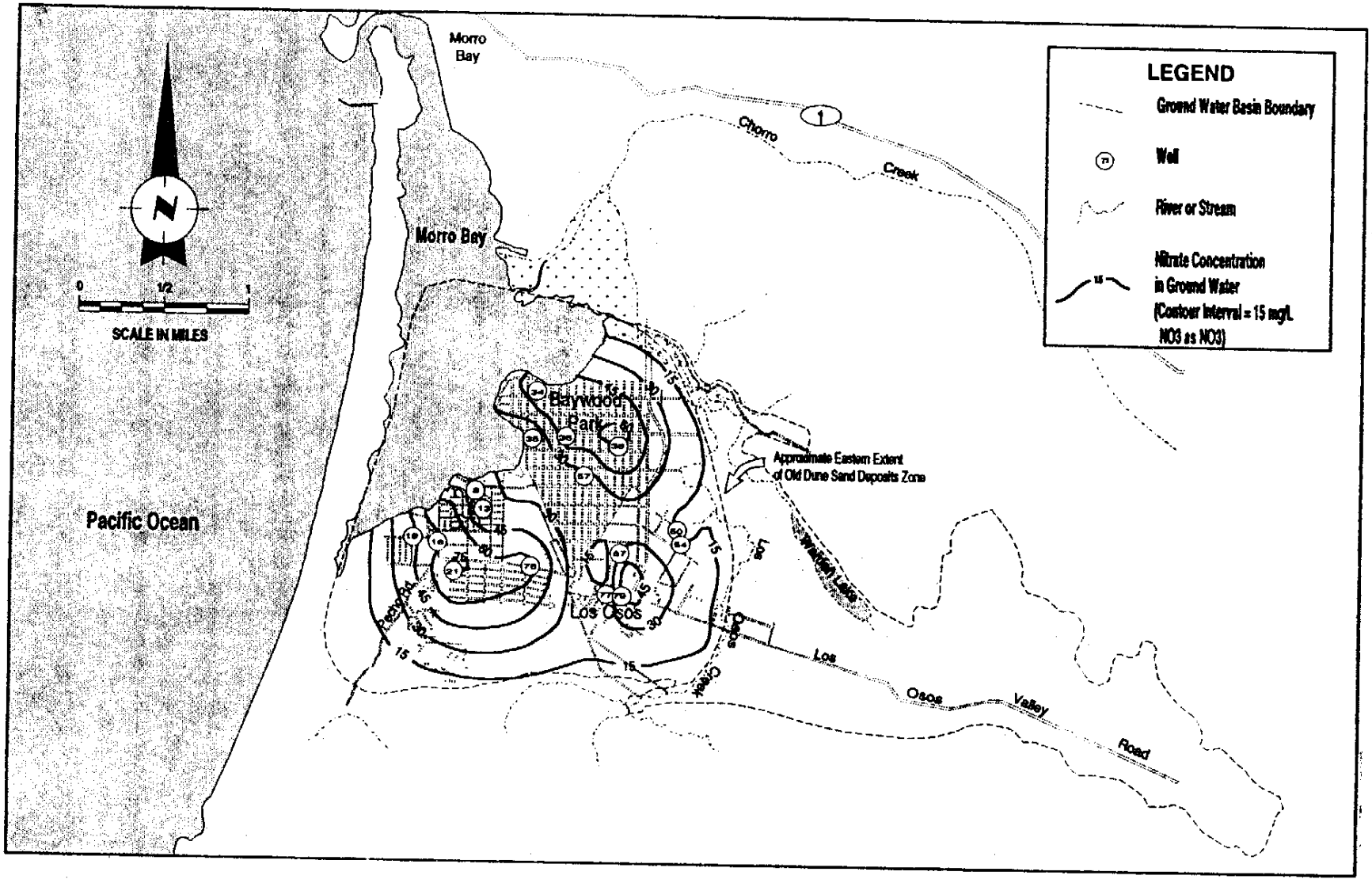

Figure XII-5. Average Nitrate Levels in the Old Dune Sand Aquifer of the Los Osos Valley Ground Water Basin from 1985 to 1994

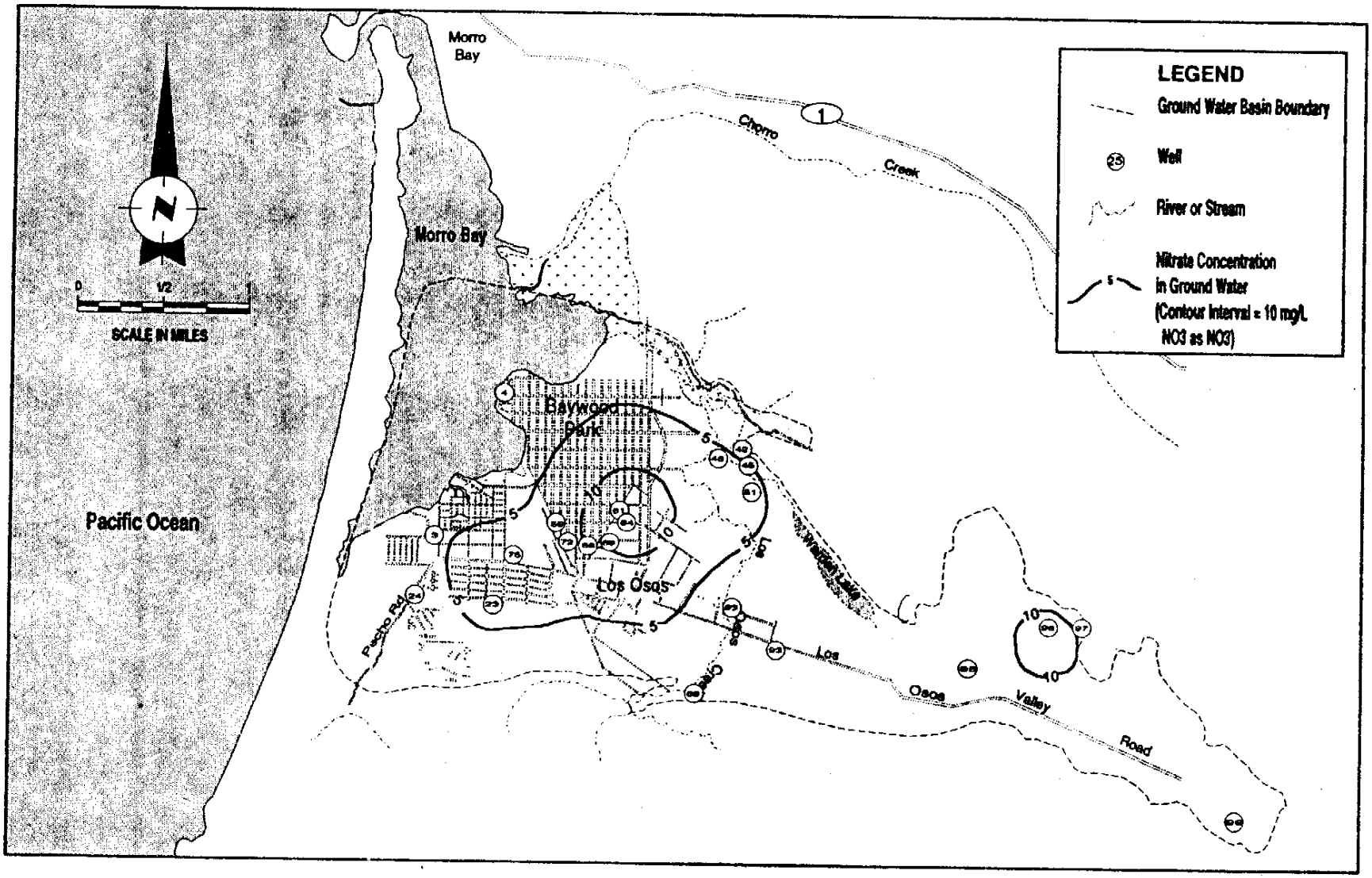

Figure XII-6. Average Nitrate Levels in the Paso Robles and Alluvium Aquifers of the Los Osos Valley Ground Water Basin from 1954 to 1973

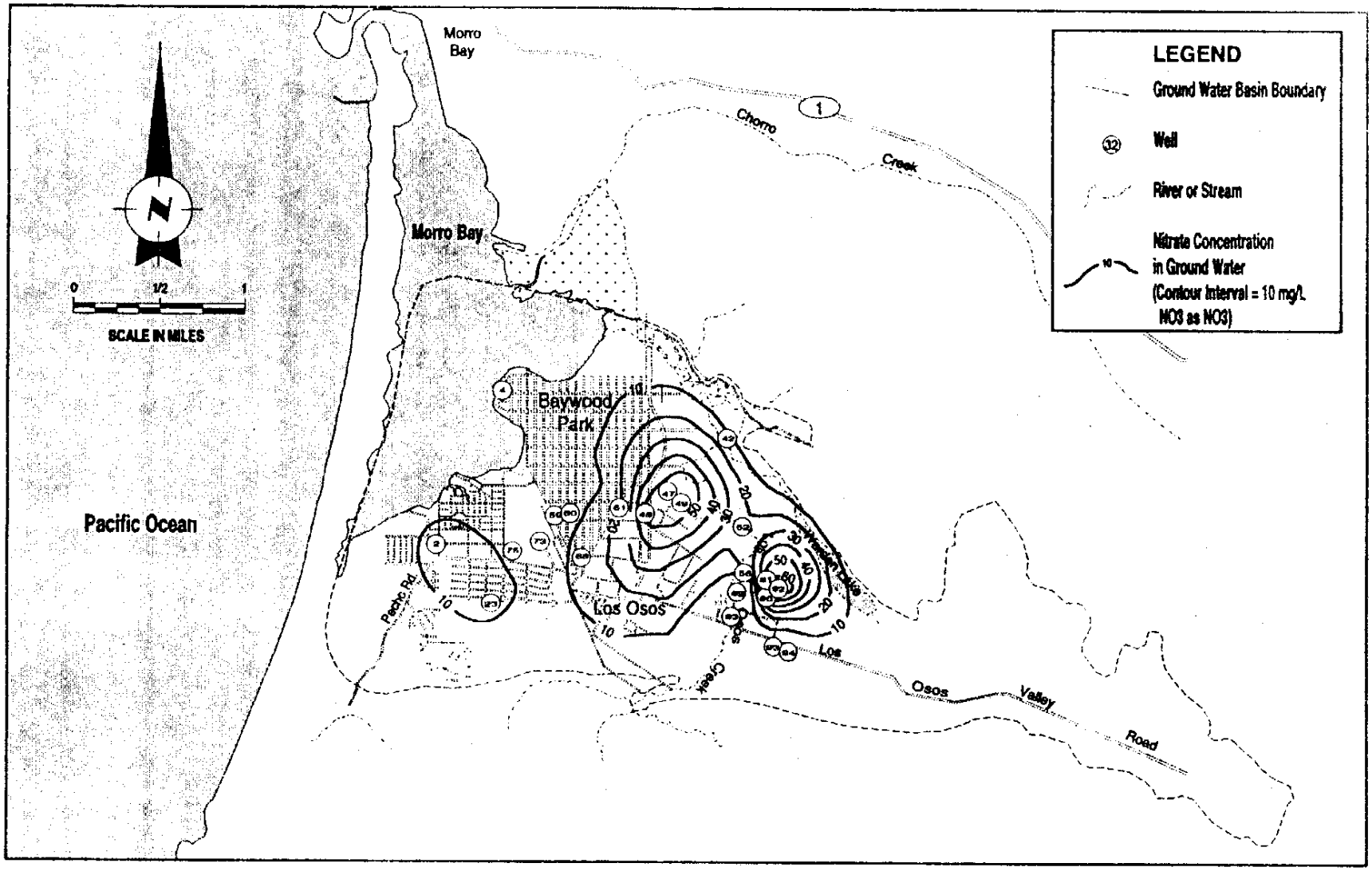

Figure XII-7. Average Nitrate Levels in the Paso Robles and Alluvium Aquifers of the Los Osos Valley Ground Water Basin from 1974 to 1984

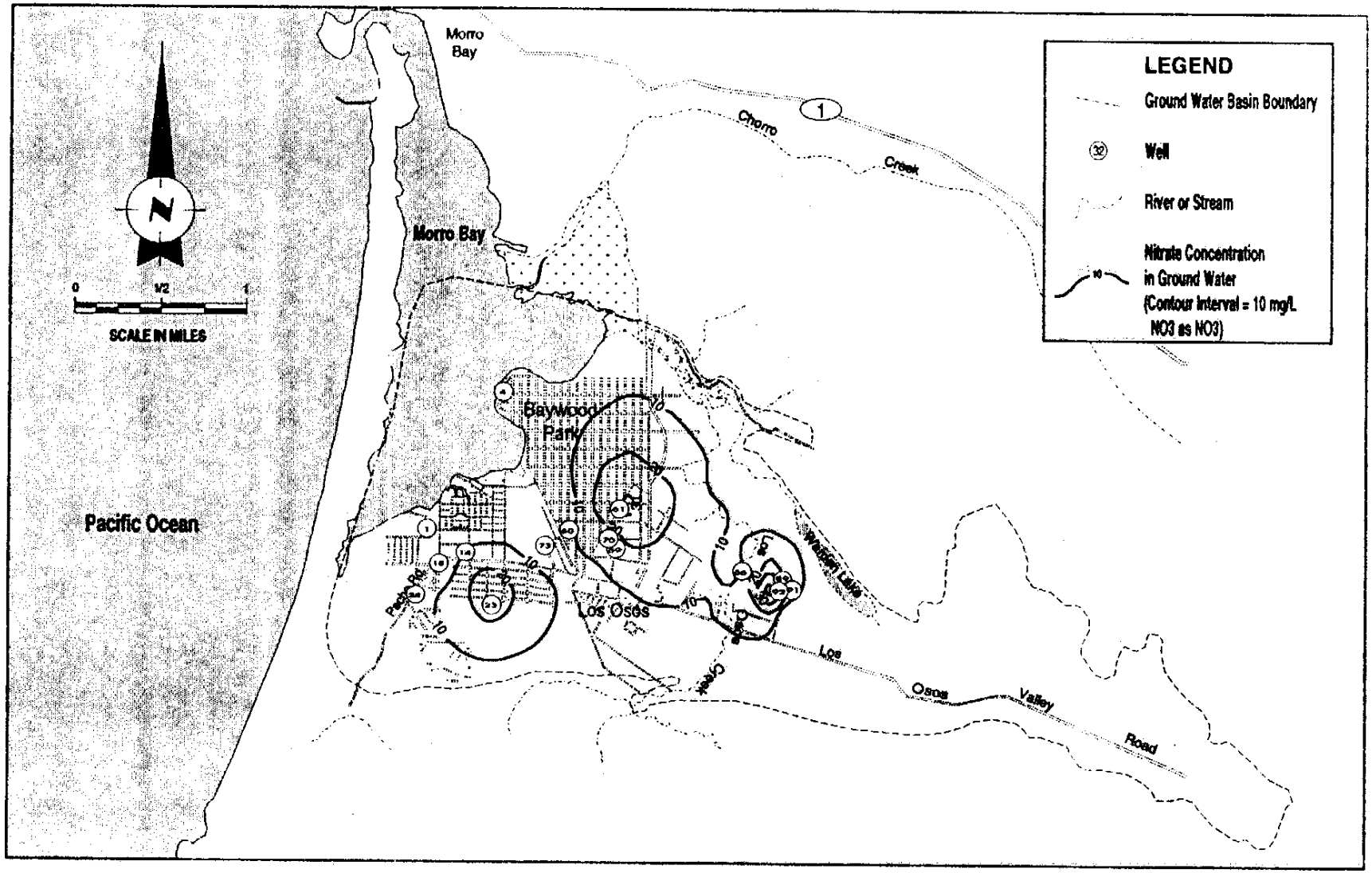

Figure XII-8. Average Nitrate Levels in the Paso Robles and Alluvium Aquifers of the Los Osos Valley Ground Water Basin from 1985 to 1994

Figure XII-6 represents the 1954 to 1973 time frame. Wells sampled directly below the community of Los Osos/Baywood Park generally average 10 mg/l nitrate, as NO3, or less. Another plume east of this community also shows nitrate concentrations of the same magnitude.

Figures XII-7 and XII-8 provide contours for the Paso Robles Formation between 1974 to 1984 and 1985 to 1994, respectively. One significant finding for the Paso Robles aquifer is nitrate concentrations have been steadily increasing in the vicinity of Los Osos Valley Road and Pecho Road. Average nitrate concentrations from 1954 to 1973 were less than 10 mg/l nitrate, as NO3 (see Figure XII-6). In the late 1970's and early 1980's, the average nitrate concentration rose to 10 mg/l nitrate, as NO3 (see Figure XII-7). In the late 1980's and early 1990's, a 20 mg/l nitrate, as NO3 plume developed.

A comparison of the 1974 to 1984 and 1985 to 1994 time frames appears to indicate a decrease in nitrate concentrations in the central and eastern portions of the community. However, as discussed below, the data is so discontinuous between the two time periods, that no conclusions can be reached until additional sampling is completed. The necessary sampling is described directly below. For example, well number 92 needs further sampling. From 1973 to 1984, only three sampling events occurred; all were in 1984. From 1985 to 1994, only two sampling events occurred; both were in 1987. Sampling is necessary to validate recent water quality trends.

Furthermore, well numbers 80 and 81, located near well number 92, had eight and nine sampling events, respectively; all occurred between 1974 to 1978. No sampling events occurred after 1978.

Another well, near well number 92, which requires additional monitoring is well number 89. This well had only three sampling events; all occurred in 1989. The most recent concentration was approaching the state drinking water standard of 45 mg/l nitrate, as NO3. Sampling is necessary to verify compliance with state standards.

In the central portion of the community, a 50 mg/l nitrate, as NO3, contour (centered around well numbers 47, 48 and 49) has many monitoring data for the 1974 to 1979 period. However, sampling of these wells was not performed after 1979. One cannot determine the recent trend of this contour without more sampling.

One other well which requires further testing is well number 61. Although well number 61 has abundant data between 1958 to 1987, no recent sampling events have occurred since 1987. Monitoring data up until 1978 indicated low levels of nitrate contamination. However, these levels have increased during the mid 1980's to a level above the state drinking water standard of 45 mg/l nitrate, as NO3.

Table XII-1. Wells Recommended for Further Testing in the Los Osos Valley Ground Water Basin.

State Well Number	Report Well Number	State Well Number	Report Well Number
30S/10E-13P01	20	30S/11E-18N01	76
30S/11E-08J01	38	30S/11E-20A01	80
30S/11E-17E01	47	30S/11E-20A02	81
30S/11E-17E04	48	30S/11E-20D02	89
30S/11E-17F02	49	30S/11E-21D13	92
30S/11E-18H01	61		

References

Brown and Caldwell. "Phase I Water Quality Management Study." Volume 1 - Project Report. April 1983.

United States Geological Survey (USGS). "Hydrogeology and Water Resources of the Los Osos Valley Ground-Water Basin, San Luis Obispo County, California. 1988.

SAN LUIS OBISPO COUNTY
DEPARTMENT OF PLANNING AND BUILDING

VICTOR HOLANDA, AICP
DIRECTOR

Hi David:

These are all the septic system repairs for 2008 and 2009 for Los Osos. Someone from your office requested we keep track of these repairs and send a copy of the records to your office every year. I don't think we sent in 2008, so I am sending you both years.

If you have any questions please give me a call at 781-5628

Barry

FEB 25 2010

COUNTY GOVERNMENT CENTER • SAN LUIS OBISPO • CALIFORNIA 93408 • (805) 781-5600
EMAIL: planning@co.slo.ca.us • FAX: (805) 781-1242 • WEBSITE: http://www.sloplanning.org

2008

LOS OSOS SEWAGE DISPOSAL SYSTEM REPAIRS

Name	Address	Permit #	Installer	Inspector	Insp. Date
MADDY	1220 16th st	7-01824	AL's	BT	2/1/08
Gibbs	248 Travis	7-01795	AL's	TA	2/19/08
Goodale	781 Highland	7-02000	AL's	TA	2/19/08
Nishikawa	1374 Nipomo	7-01995	AL's	TA	2/19/08
Weller	1821 8th st	7-01904	AL's	TA	2/14/08
LAZO	1410 13th st	7-02047	AL's	BT	2/26/08
KROLL	531 RAMONA	7-02232	BP	BT	3/3/08
Lolley H	1247 3rd st	7-02170	AL's	TA	3/14/08
Ritter	1099 EL Morro	7-02249	ALS	BT	3/28/08
Freira	12th st	7-02252	ALS	BT	3/28/08
Hurley	1751 Fearn	7-02462	BP	BT	4/1/08
ATKINS	1802 11th st	7-02344	AL's	BT	4/1/08
GARDEN CAFE	1188 LOVR		Storey	BT	4/11/08
Murphy	1408 LA Serena	Reclamator	Self	BT	4/7/08
DICUS	1190 11th st	7-02443	AL	BT	4/17/08
~~NAGEL~~	~~541 Diego Pl~~				
Fischer	1487 7th st	6-02127	AL	TZ BT	4/10/08
Len	1232 4th st	7-02535	AL's	DR	5/2/08
Miller	381 Travis	7-02342	AL's	BT	5/7/08
Norman	1821 13th st	7-02643	ALS	BT	5/8/08
Bender	1389 13th st	7-02962	BP	RM	5/6/08
CADWELL	1851 Fearn	7-02642	AL's	BT	5/20/08
WRIGHT	433 Binscarth	7-02767	AL's	BT	5/29/08
MARSHALL	1790 11th st	7-02921	AL's	BT	6/6/08
Nice	312 Henrietta	7-02766	ALS	BT	7/18/08
NAbhan	2216 Glenn	8-00105	AL's	BT	7/18/08
BIERING	2300 Bayview	7-03104	AL's	BT	7/18/08

2008

LOS OSOS SEWAGE DISPOSAL SYSTEM REPAIRS

Name	Address	Permit #	Installer	Inspector	Insp. Date
KUDART	2036 Ferrell	7-02444	AL'S	BT	4/23/08
Mori	2249 Del Norte	8-00441	AL's	BT	8/28/08
Childress	337 Highland	8-00430	ALS	BT	9/3/08
Burke	1815 10th st	8-00533	AL'S	BT	9/16/08
Renard	1212 17th st		Storey	MV	9/19/08
Book	1936 7th st	8-00440	AL'S	BT	9/24/08
Jones	1323 8th st	8-00608	AL's	BT	9/25/08
Moody	1261 15th		Storey	BT	10/1/08
Field	397 Henrietta	8-00609	ALS	BT	10/6/08
Thorensen	1861 9th st	8-00611	AL's	BT	10/9/08
Halley	2780 Covey	8-00761	AL'S	BT	10/10/08
Owens	1566 4th	8-00764	ALS	BT	10/16/08
CAVAGNARO	1585 4th st	8-00763	AL'S	BT	10/21/08
Meissinger	1667 5th st	8-00811	AL'S	BT	10/22/08
Kimabe	2589 QUAIL	8-00978	BP	BT	10/28/08
Bahme	2190 Palomino	8-00812	ALS	BT	10/30/08
Clifford	2014 W. How	8-00990	BP	BT	11/4/08
Stern	1742 Martingale	8-00901	ALS	BT	11/5/08
DIXON	1772 LOVR	8-00863	ALS	BT	11/6/08
Slow River	995 LOVR	8-00813	AL'S	BT	11/19/08
Molinari	1901 13th	8-00979	AL'S	BT	11/20/08
NAKamara	1096 Nipomo	8-01068	ALS	BT	12/5/08
Mesecher	1733 Mountainview	8-01260	BP	BT	12/9/08
SLOAN	1481 15th st	8-01072	ALS	DR	12/4/08
Duggan	1870 8th st	8-01067	ALS	BT	12/10/08
OLSON	640 Highland	8-01125	AL'S	BT	12/16/08
Cunningham	1247 14th st	8-01159	AL'S	BT	12/19/08

2009

LOS OSOS SEWAGE DISPOSAL SYSTEM REPAIRS

Name	Address	Permit #	Installer	Inspector	Insp. Date
Dillingham	392 Mitchell	8-01259	BP	BT	1/5/09
OLSON	2788 Crockett Cir	8-01287	AL's	BT	1/22/09
Shaiken	1847 Mountain View	8-01286	AL's	BT	1/22/09
Eddy	708 WOODLAND	8-01436	BP	BT	1/26/09
Kanning	2230 So Bay Blvd	8-01498	BP	BT	2/3/09
Long-Meyers	2028 Farrell	8-01285	AL's	BT	2/4/09
Whitsel, K	1387 6th st	8-01473	AL's	BT	2/24/09
Bank of NY	1965 10th st	8-01553	AL's	BT	3/3/09
Peters	1818 Los Osos	8-01554	AL's	BT	3/5/09
Downey Savings	1981 11th st	8-01576	AL's	BT	3/23/09
Eyster	1500 16th st	8-01555	AL's	BT	3/23/09
Windshaw	2233 ELDorado	8-01637	AL's	BT	3/24/09
Delbagatta	671 WOODLAND	8-01729	ALs	BT	3/27/09
Stern	640 Santa Lucia	8-01730	AL's	BT	4/9/09
Kracombrinte	1783 7th st	8-01861	AL's	BT	4/16/09
Spiegel, ED	1753 9th st	8-01945	ALS	BT	4/27/09
Daniels, S	538 Henretta	8-01862	ALS	BT	4/28/09
Furster, R	1785 13th st	8-01995	AL'S	BT	5/4/09
Jenkins,	2150 Pecho	8-01996	AL'S	BT	5/12/09
Cohn	1624 12th st	8-02067	CLAYS	BT	5/13/09
AVANT	1431 4th st	8-02191	AL's	BT	6/2/09
Young, M	1487 Nipomo	8-02188	Strokes	BT	6/3/09
Fleming, G	2025 Bush	8-02241	AL'S	BT	6/5/09
Haveter	1272 6th	8-02237	AL'S	BT	6/9/09
Thrasher, M	2789 Crockett	8-02190	AL'S	BT	6/11/09
Zerete	780 Manzanita	9-00032	BP	BT	6/19/09
Brothwell	495 Henrietta	8-02322	AL'S	BT	6/25/09

2009

LOS OSOS SEWAGE DISPOSAL SYSTEM REPAIRS

Name	Address	Permit #	Installer	Inspector	Insp. Date
TOPP	872 Highland	8-02235	AL's	BT	6/25/09
Dougherty	426 Lupine		BP	MV	7/10/09
Hendry	2580 Bay Vista	9-00107	ALS	BT	8/4/09
Thomas	2200 Fresno	9-00163	AL's	BT	8/5/09
Diaz	948 Santa Maria	9-00161	AL's	BT	8/6/09
Wright	1872 6th st	9-00440	BP	BT	8/17/09
Holland	1392 7th st	9-00264	ALS	BT	8/18/09
Gravelle	756 Lilac	9-00162	AL's	BT	8/24/09
Silverstrom	1279 11th	9-00330	AL's	BT	8/28/09
XIA OVAN	2364 Winnel	9-00229	AL's	BT	9/9/09
Auchterlonie	1765 Pine	9-00380	AL's	BT	9/9/09
Wright	1377 17th st	9-00462	BP	BT	9/14/09
Sharpnack	1274 Vista Del Oso	9-00443	BP	BT	9/15/09
Nuttal	401 ROSINA	9-00379	AL's	BT	9/25/09
Moylan	1516 17th st		BP	BT	9/28/09
Wright	1835 12th st	9-00516	ALS	BT	10/1/09
Gibson	2101 Buckskin	9-00517	AL's	DB	10/16/09
GAIR	1144 16th st	9-00404	AL's	BT	10/21/09
Romero	2801 Alamo	9-00078	AL's	BT	10/21/09
Hoffman	2530 Quail	9-00515	AL's	BT	10/22/09
Kirdi	2199 10th	9-00924	BP	BT	11/3/09
Knight	1281 17th st	9-00738	ALS	BT	11/17/09
Henderson	1320 Pasadena	9-00757	AL's	BT	11/20/09
Streeter	2098 Pecho	9-00805	AL's	BT	11/23/09
PACACAN	1090 Paso Robles	9-00806	AL's	BT	12/8/09
Perry	1439 11th st	9-00787	AL's	BT	12/8/09
Renstrom	2841 Mesa Alta	9-00925	BP	BT	12/3/09

DRAFT

SAN LORENZO RIVER WATERSHED MANAGEMENT PLAN UPDATE

December, 2001

County of Santa Cruz
Water Resources Program
Environmental Health Services
and
Planning Department

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Summary of 1979 Plan Implementation and Ongoing Recommendations

This Update Report is not intended to provide an extensive evaluation of the successes and failures of the 1979 Plan recommendations. This report is intended to evaluate current watershed issues, summarize efforts to address those issues, and make recommendations for maintenance and enhancement of effort, primarily in the area of water quality, erosion and sedimentation, water resources management and fishery protection. Following is a summary of outstanding issues and needed efforts that will be further addressed in the subsequent sections.

Water Quality

Status: Programs to implement the 1979 Plan recommendations regarding septic system management and nutrient reduction were eventually put in place by 1995, 16 years after Plan adoption. Resulting improvements in bacteria levels and nitrate levels have already been observed. Urban runoff control measures were partially implemented, but toxic contaminants from urban runoff have not been documented to be as much of a problem in the San Lorenzo Watershed as originally envisioned in the 1979 Plan. Measures to reduce bacteria levels in wet weather and dry weather urban runoff have been implemented, but further effort is needed. Contamination of groundwater by leaking underground storage tanks has emerged as a substantial issue subsequent to the 1979 Plan.

Needed Efforts:

1. Continue to implement the San Lorenzo Wastewater Management Plan and Nitrate Management plan to upgrade existing onsite sewage disposal systems, reduce pathogen levels and nitrate levels.
2. Implement urban runoff management measures to reduce dry weather and wet weather pathogen levels in urban and suburban areas:
   a. Promote good housekeeping practices through education, ordinance, and agency practices for proper management of pet waste, garbage, storm drain inlets, and food facilities
   b. Investigate and correct infiltration and illicit connections between sanitary sewers systems and storm drains.
3. Promote good livestock management practices to reduce discharge of sediment, nitrate and pathogens.
4. Strengthen efforts to remediate and prevent further groundwater contamination from leaking underground tanks and hazardous discharges.

Erosion Control and Sedimentation

Status: Stronger regulations were implemented to reduce erosion from new development, but many of the recommendations for funding and technical assistance to address existing chronic erosion sources were not fully implemented due to significant funding cutbacks in local and federal programs. Stream sedimentation has not improved substantially since adoption of the 1979 Plan. Chronic sediment contribution from public and private roads remains as a significant source of stream degradation, although significant steps are being initiated to start to address these problems.

Sources of Impairment

Nitrate

Nitrate levels in the River are estimated to be 5-7 times above natural background levels (SCCHSA, 1995). At about 0.35 mg-N/l, nitrate levels in the River are well below the safe drinking water standard of 10 mg-N/l. However, nitrate is the limiting nutrient in the River and increased nitrate levels can stimulate biological growth of algae, molds, fungi, and other organisms. This increased biological activity threatens drinking water supply by releasing organic compounds, which cause noxious tastes and odors and produce potentially carcinogenic disinfection byproducts when the water is treated. Localized concentrations of nitrate in groundwater have at times threatened to violate the drinking water standard in areas of Ben Lomond, Boulder Creek, and Scotts Valley.

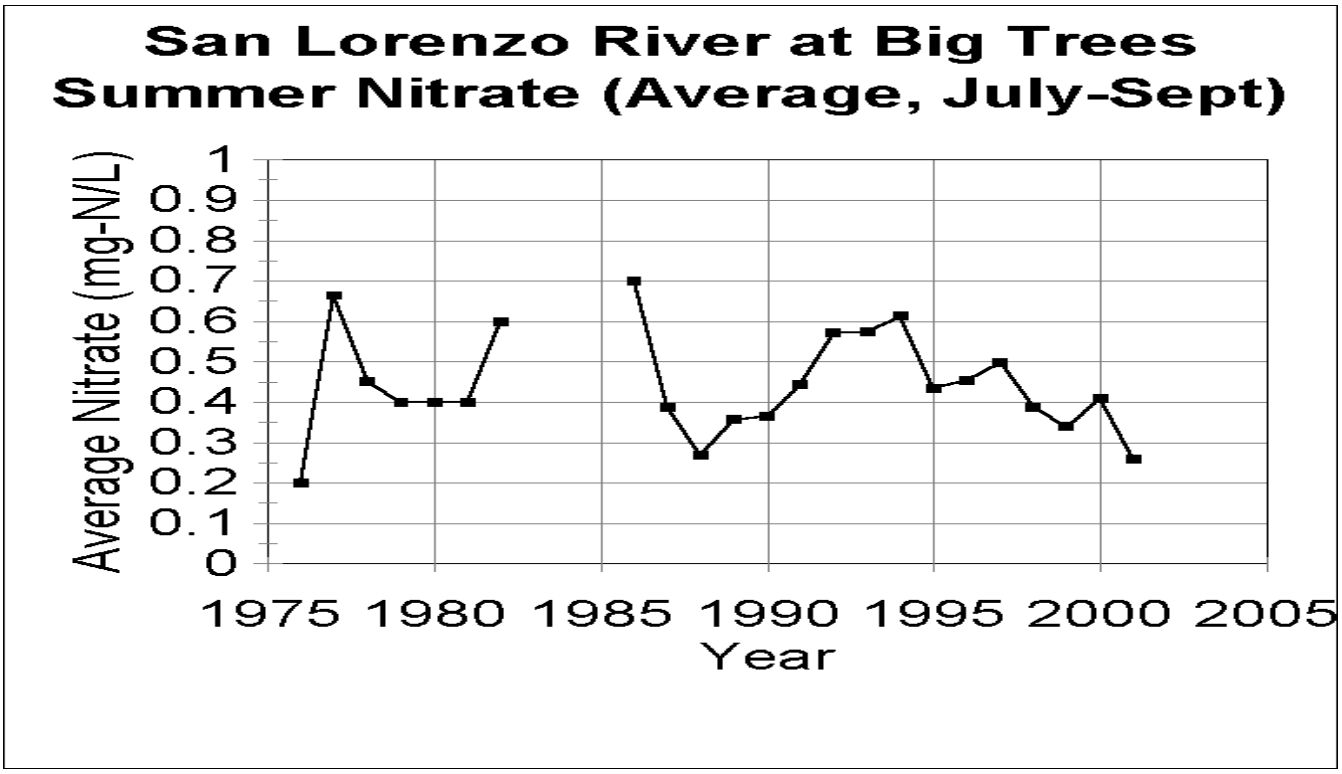
The San Lorenzo Nitrate Management Plan (SCCHSA, 1995) determined that an estimated 84% of the current nitrate load in the River results from human activities in the watershed. Calculations of relative contributions to present summer nitrate levels in the lower River (at Felton) are as follows:

- Septic Systems in sandy areas	38%
- Septic Systems in non-sandy areas	19%
- Natural sources in sandy areas	12%
- Sewer discharge from B.C. Country Club	10%
- Scotts Valley nitrate plume	9%
- Livestock and stables	6%
- Natural sources in non-sandy areas	4%
- Landscaping/fertilizer use	2%

Approximately 67% of the nitrate in the River during the summer comes from areas underlain by sandy soils of the Santa Margarita Sandstone. A septic system in sandy soils contributes 10-15 times as much nitrate to the River as a septic system in less permeable soils. Nitrogen reduction efforts are most needed and will be most effective in areas with sandy areas.

In some parts of the country, harvesting of timber can cause significant release of nitrate to streams. Several monitoring efforts in the San Lorenzo Watershed have indicated that timber harvests are not a significant source of nitrate in this area. This is likely due to several factors: the relatively small extent of individual harvests, harvests are not clear-cuts, forest soils in the San Lorenzo Watershed tend to be more clay-rich and hold onto nitrate, and the other sources of nitrate in San Lorenzo tend to be much more significant than any contribution from timber harvests.

Figure 4: Nitrate Trends in the San Lorenzo River at Big Trees



Pathogens

Presence of bacteria, virus, giardia, cryptosporidium, and other pathogens can make the water unsafe for swimming and require more expensive treatment efforts for drinking water supply. Practically all of the testing for pathogens involves testing for indicator bacteria (total coliform, fecal coliform, E. coli, and enterococcus) that would suggest the possible presence of pathogens from sewage, fecal contamination, or other contamination. Limited testing for pathogens by the City of Santa Cruz has confirmed the presence of cryptosporidium and giardia in the San Lorenzo River. The presence of indicator bacteria, while not necessarily causing illness, causes beaches to be posted with warning signs and significantly impacts recreational opportunity. The frequency of posting of swimming areas in the watershed has declined significantly since the 1970's and the 1980's, as septic systems have been upgraded and better maintained. However, the Rivermouth continues to have consistently high bacteria levels and is permanently posted as unsafe for swimming. Sources of pathogens and indicator bacteria are non-point source urban runoff, failing septic systems, sewer system leaks, pet waste, livestock, encampments, and waterfowl.

There are over 13,000 septic systems in the San Lorenzo Watershed upstream from Santa Cruz. Under current wastewater management programs, the occurrence of septic system failures is relatively low. Since 1986, the wintertime septic failure rate has declined from 5-14% to 1-3%, depending on the area (SCCHSA, 2000). However, during rainfall periods, partially treated sewage

which comes to the ground surface from septic failures can be readily washed into ditches, roadways, creeks and then the River. For brief periods after storms and in the early spring when water tables are high, ditches may continue to run, conveying diluted sewage to creeks. During dry periods, sewage from failing septic systems would not reach a waterway unless the failure was right on the banks of the creek. Programs implemented since 1986 have required system upgrades, improved setbacks from creeks and early identification of failures. Summer bacteria levels have shown substantial improvement, and the River generally meets standards for safe swimming at all areas upstream from Santa Cruz. Subsurface contribution of bacteria from apparently functioning septic systems has not been found to occur in the San Lorenzo Watershed (SCCHSA, 1989). Dry season bacteria in the upstream areas are most likely from nonspecific urban sources. The highest levels of indicator bacteria are consistently observed in the more dense urban areas of Santa Cruz and Scotts Valley, which are sewered, indicating most of the bacterial contamination is more related to urban runoff than septic systems. Bacteria levels drop substantially as the River flows out of the suburban areas and through the State Parks or other low-density areas.

Livestock operations are also a potential source of bacterial contribution during storm periods. It is estimated there may be some 400-600 head of livestock kept in the watershed, primarily horses in commercial stables and small homeowner operations. Runoff from paddock areas, trails and manure stockpiles during storms can contribute elevated levels of fecal coliform, Cryptosporidium, and other organisms. Except where animals are allowed into creeks, stables are not a significant source of microbiologic contamination during nonstorm periods. County Environmental Health has had success with improvement of runoff and manure management at many of the larger operations. However, additional effort is needed.

As a part of this project, the County conducted extensive testing in the lower River area from 1995 through 1997 to better assess the sources of high bacteria in the urban reach of the River. The work found consistently high levels of bacteria downstream from the confluence with Branciforte Creek, which originate from storm drain discharge to the River and Branciforte Creek, as well as the concentrations of waterfowl that congregate in that area. Although the storm drains typically have very high bacteria levels, their dry weather flow is generally light and intermittent. High levels of bacteria in storm drains originate from decaying organic material (including garbage, leaves, and pet waste), occasional sewage spills, and possible subsurface leakage of sanitary sewer systems. Sewage leaks have been confirmed in several storm drains and subsequently corrected, resulting in a decline in bacteria levels in those drains. Leakage may persist in some drains. Since the 1997 sampling, the sewer lines in the vicinity of Branciforte Creek were upgraded and bacteria levels from the Creek have declined significantly. However, the general nonspecific urban contamination keeps the bacteria levels elevated well above standards for safe swimming. Storm sampling of ditches and gutters with no likely sewage influence frequently yielded high levels of indicator bacteria. It has not been confirmed whether pathogens are also present.

Water quality sampling using the four standard bacteria indicators was coupled with a health risk survey of persons in the water to determine the health risk of swimming in areas adjacent to the San Lorenzo River mouth as well as other areas designated as swimming/surfing areas. The health risk survey showed that there are generally low levels of indicator bacteria producing a good quality swimming water in the beaches adjacent to the mouth of the San Lorenzo River as well as upstream of the City of Santa Cruz in the San Lorenzo River. While the safe swimming standard was almost always exceeded at the mouth of the river only one person out of the 165 persons interviewed that had been swimming or wading in that area became ill. During the study, a total of 1325 people were interviewed at all areas. Eleven cases of illness from swimming were reported.

The program provides for management and improvement of approximately 13,500 individual onsite sewage disposal systems in the San Lorenzo River Watershed, which have historically contributed to elevated nitrate and pathogen levels in the River. Proper septic system functioning has been challenged by age of systems, small lot size, high winter groundwater levels, steep slopes, close proximity to waterways, and common occurrence of clay soils or excessively drained soils. The Wastewater Management Program has sought to overcome these constraints through water quality monitoring, system inspection, upgrade of systems to effective standards, public education, and tracking of system performance.

Table 6: Summary of Wastewater Management Activities in the San Lorenzo Watershed, 1986-2000

Details are presented in Table 7.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	**Total**
Inspections - Surveys and Rechecks	687	496	96	158	284	1842	1723	1658	1343	1169	1532	1795	1562	1745	792	**16,882**
Repair Permit Applications	207	151	160	177	235	268	361	336	310	303	317	333	277	320	358	**4,113**
Tank Pumping (Private Pumpers)	- -	- -	1210	1721	1789	1796	1893	1752	1954	1984	1936	2039	2072	2099	2074	**24,319**
Water Samples	1391	1191	1119	1009	1056	1087	1293	1227	1164	1623	1243	827	1198	790	810	**17,028**

Activities within the main elements of the Wastewater Plan can be summarized as follows:

Evaluation of Existing Onsite Sewage Disposal Systems - Over 11,700 parcels have been inspected, and over 80 boreholes or shallow monitoring wells have been installed to evaluate soil and groundwater conditions. Data on inspection results, pumping history, septic system characteristics, and site characteristics has been entered into a computerized database for 12,500 of the 13,500 septic systems in the Watershed. This information has been combined with data from water quality monitoring to evaluate the current performance and the potential for continued use of individual onsite disposal systems in various communities of the Watershed. Despite the constraints present, the large majority (at least 85%) of the systems evaluated were found to be functioning well, and it expected that all but about 10% can ultimately be upgraded to meet current standards using conventional technology. The remainder will likely require use of alternative systems or nonconforming systems with a higher level of oversight.

Disposal System Improvements Completed - Minimum standards for septic system repairs were established by ordinance in 1993, and were strengthened further in 1995, pursuant to the adopted Wastewater Management Plan. At least 2500 systems have been upgraded under permit between 1986 and 1998. The number of system repair applications is currently about 300 per year, an increase of 50% since the beginning of the program. The impetus for system upgrade has been: independent property owner initiative (66%), building remodel (9%), loan inspection (11%), complaint investigation (5%), and inspections done under the Management Plan (9%). In 1996-98, 90% of the system repairs were able to meet the requirements for a standard conventional system. At the end of 1998, 40 alternative systems had been installed in the Watershed: 24 mounded bed systems, 3 at-grade systems, 9 sand filters, and 4 other enhanced treatment units. IN the two years

Notes for Table 7:

1. For 1986 - 1991, complete inspection records are available only for surveys. After 1991, inspections include: surveys, rechecks, complaint investigations, and loan inspections. Total summaries for inspections only are for the period 1992-95. For repair actions, records may be inconsistent prior to July, 1991, when systematic data entry began. Pumping records are good after Sept., 1988, when submittal of pumping reports became mandatory.

2. Numbers of problems under inspections, and total failure rates (unless otherwise indicated) are the total number of leachfield failures and greywater discharges for that year divided by the total number of inspections for that year. Under each type of inspection, the percentage of problems found during that type of inspection is also indicated for each year.

3. Under tank pumping, the area failure rate is the number of failures, divided by the total number of parcels in the study area.

4. Number of repairs is the number of repair permits applied for in that year. Repair figures for 1986 and 1987 also include other repair activities that do not require a permit.

Evaluation of Potential for Community Disposal Systems - The Management Plan calls for an evaluation of the potential for use of community disposal systems for areas where there are severe constraints for meeting current standards using conventional septic systems. Under this program, community disposal alternatives have been explored for parts of Boulder Creek, Brook Lomond, Ben Lomond, Glen Arbor, and Felton. For all areas, community disposal systems were found to be less cost-effective than use of individual systems (including alternative systems) and were found to be unaffordable without some kind of grant funding. A community disposal system could be considered for downtown Boulder Creek, which might be eligible for economic development grants since constraints to standard sewage disposal is limiting expansion of the business district. A community disposal feasibility study has been completed for 900 parcels in the Greater Pasatiempo area, in the lower part of the Watershed, and a sewer project is currently being pursued for that area.

New Development - Any new development served by septic systems, which is the majority of the Watershed, must fully meet current standards, including a one acre minimum parcel size, regardless of the date of parcel creation. This requirement was implemented in 1983 in response to State direction to prevent an increase in cumulative impacts from septic systems. Expansion or remodel of existing development does not need to meet the minimum parcel size, but other standards must be met. Expansion of existing development provides a good trigger to bring older systems up to current standards. During the period of 1992-98, 244 permit applications for septic systems to serve new homes were received, and about 390 applications for major residential additions have been received. Over 224 septic system repairs were related to building remodels (almost 10% of the total repairs).

Water Quality Monitoring - An average of about 1000 water samples per year are currently being collected to measure trends in water quality and identify problem areas. Both nitrate and bacteria levels are significantly elevated above natural background levels in the River and many of its tributaries. Although there have been episodes of bacterial contamination from individual septic system failures, much of the bacteria contamination seems to be related to nonspecific nonpoint contamination in the relatively dense urban areas. Most of the nitrate increase is attributable to septic systems, particularly in sandy soils. There have been significant localized improvements in bacteria

levels, and there appears to be an improving trend in bacterial levels at most stations since 1996. Nitrate levels and loading in Boulder Creek and the River north of Ben Lomond declined significantly as a result of upgrades of the Boulder Creek Country Club (CSA 7)Treatment Plant.

Program Administration and Financing - The annual budget for countywide wastewater management activities is about $102,500, with an additional $237,5000 for activities specific to the San Lorenzo. (Roughly 60% of the parcels in the county with septic systems are located within the San Lorenzo Watershed.) These budget figures do not include permit processing activities. The program is funded primarily by annual service charges collected from property owners with septic systems. Since 1996-97, the countywide service charges have been $6.90 per parcel, with an additional $18.56 per parcel paid by property owners in the San Lorenzo Watershed. In late 1995, the State Water Resources Control Board approved the County's request for $2.2 million from the State revolving Fund to set up a loan program to facilitate septic system repairs. This program has been available since summer of 1998, and is currently being updated to be more usable.

San Lorenzo Nitrate Management Plan and Nitrate TMDL

The San Lorenzo Nitrate Management Plan was developed to address all major sources of elevated nitrate in the River. A grant was obtained under Section 205j of the Clean Water Act to investigate the impacts of nitrate on algae growth and water supply, to determine the primary sources of nitrate in the watershed, and to evaluate various alternatives for nitrate reduction. The Plan includes a watershed nitrate budget, which was used to calculate resulting nitrate levels in the River under different scenarios. The adopted Plan represented a balance between cost and available technology and the need to reduce nitrate levels by a moderate amount in order to reduce potential threats to drinking water quality and recreation. The San Lorenzo Nitrate Management Plan was adopted by the County and State in 1995. The Plan findings and recommendations also formed the basis for the Nitrate TMDL (Total Maximum Daily Load Plan) that was adopted by the Central Coast Regional Water Quality Control Board in 2000.

The recommended nitrate management plan provides for implementing the most cost-effective measures to achieve the desired level of nitrate reduction. The plan provides for limiting increased nitrate release from new or expanded development in sandy soils, and gradually reducing nitrate discharge from existing sources as public and private funds become available and reduction technology improves. Implementation of the recommended policies will provide for a 15-20% reduction in current nitrate levels over the next 10 years, with a further reduction of 10% in the following 10 years. The following measures were recommended (the status of implementation is shown in parentheses):

Manage Wastewater Disposal for Nitrogen Reduction

1. Maintain the existing requirement of a one acre minimum parcel size for new development served by septic systems in the San Lorenzo Watershed (Ongoing)

2. Implement improved wastewater disposal management through the San Lorenzo Wastewater Management Plan (Ongoing).

CHAPTER 3: HYDROLOGY, GEOMORPHOLOGY & WATER QUALITY

3.0 Introduction

This chapter describes the natural processes and human impacts that have influenced the landscape from which the District's water supply flows. The chapter begins with an overview of landscape evolution, describing the natural processes and human activities that have contributed to shaping the landscape. The chapter then provides an overview of the geology and soil types. Finally, the chapter discusses human impacts and land use activities in terms of their impacts to water quality.

Hydrology is the study of the distribution of water on and near the earth's surface. Because the amount of water is finite, it constantly moves through the hydrologic cycle in processes known as precipitation, infiltration, percolation and groundwater storage, evaporation and transpiration, and surface water runoff.

Geomorphology is the study of landforms, their origin and evolution, and the processes that shape them. Landforms can be characterized by their elevation, slope, orientation, stratification, rock exposure, and soil type. The science of geomorphology seeks to explain why landscapes appear the way they do, and it seeks to use this information to predict future changes. Landscapes include landforms, climatic factors, flora and fauna, and the built environment.

Scientists predict that climate change will increasingly impact the hydrologic cycle, but the degree and severity of the impacts of climate change on local watersheds and water supplies is not known. Scientific research applicable to the central California coast indicates that climate change will bring increasingly higher temperatures, more extreme droughts and more intense rainfall. All of these factors are expected to impact the local region's water resources. Chapter 7: Local Climate Change Assessment presents a more detailed discussion of the impacts of climate change, as well as potential adaptation and mitigation actions.

3.1 Overview of landscape evolution

This section begins with an overview of the geologic processes that formed and continue to shape the Santa Cruz Mountains as a region. It then describes the three geologic areas of the San Lorenzo River watershed, and their soil types. Finally, it summarizes the role of human influences on the landscape, resulting from land use changes that began about 200 years ago.

3.1.1 Geologic formation of the Santa Cruz Mountains

According to the theory of plate tectonics, the earth's crust is formed by a number of rigid plates, which move under (a process known as subduction) and against each other, causing major dynamic events, such as uplift of mountain ranges, and earthquakes (Harden, 1998). About 145 million years ago, the Farallon Plate began to collide with the North American Plate, resulting in the subduction of the Farallon plate. During this subduction, parts of the Farallon plate were scraped off onto the North American Plate in a process called accretion (Sloan, 2006). This accretion took place over a period of about 100 million years, producing the Mesozoic rocks in today's Bay Area (Sloan, 2006).

About 28 million years ago, the subduction of the Farallon Plate was complete, bringing the Pacific Plate into direct contact with the North American Plate. Movement between these two

today than levels in the 1960s. However, the Regional Board updated the nitrate objective when they adopted the TMDL for the San Lorenzo River. Currently, nitrate levels in the River are only about 1.5 times the present objective (Ricker, 2008).

In typical soils of the watershed, approximately 25% of the nitrogen from septic systems is removed by through natural denitrification in the upper soil layers, whereas in sandy soils only about 15% is removed and approximately 75-80% percolates as nitrate to ground water (Ramlit, 1982 as cited in County of Santa Cruz, 1995). In their studies, the County of Santa Cruz (1995) found that 10-25% of the nitrogen from septic systems in the sandy areas underlain by Santa Margarita Sandstone reached the streams as nitrate. The County of Santa Cruz also determined that a septic system in sandy soils contributes 10-15 times more nitrate to the river than a septic system in less permeable soils (County of Santa Cruz, 1995). Approximately 67% of the nitrate load in the river comes from the area of the watershed comprised of the highly permeable Santa Margarita sandstone (County of Santa Cruz, 1995). Therefore, management practices to reduce nitrogen inputs in the watershed will be the most effective in sandy areas.

The County of Santa Cruz and the Regional Board have taken actions to reduce nitrate levels in the watershed (Camp, Dresser, & McKee, 1996). The County of Santa Cruz (1995) found a 20% reduction in nitrate discharge from a shallow trench compared to a deep trench in septic systems in sandy soils. The San Lorenzo River Watershed Sanitary Survey (Berry, 2001) states that nitrate levels in the San Lorenzo River were decreasing slightly from previous levels. Nitrogen control measures and management practices are described in the San Lorenzo Draft Nitrate Management Plan Phase II Final Report (County of Santa Cruz, 1995), the Draft San Lorenzo River Watershed Management Plan Update, (County of Santa Cruz, 2001), in the San Lorenzo Valley and North Coast Watersheds Sanitary Survey (Camp Dresser & McKee, 1996), in the San Lorenzo River Nitrogen Control Measure project (White and Hecht, 1994), addressing the Quail Hollow Ranch Regional Park Stables, and in numerous Santa Cruz County Resource Conservation District (SCCRCD) documents.

The Boulder Creek Country Club sewage treatment facility has been upgraded for denitrification and tertiary treatment for possible use of reclaimed water on the golf course (County of Santa Cruz, 2000). If all other sources of nitrogen are controlled within this area, it is estimated that the San Lorenzo River between Boulder Creek and Ben Lomond could experience nitrate reductions as high as 75% (Berry, 2001).

The County Draft San Lorenzo Nitrate Management Plan (1995) states that livestock and stables contribute 6% of the present summer nitrate levels in the lower River at Felton. In sandy areas, a single horse without nitrate management practices contributes nitrate to streams comparable to rates from a single household in the same area (County of Santa Cruz, 1995). Horses in sandy soils contribute a higher percentage of the nitrogen load due to the highly permeable soils rapidly transporting the untreated waste. There are also high densities of horses in sandy soil areas. For example, horses contribute 41% of the estimated nitrate load in lower Zayante Creek (County of Santa Cruz, 1995). Horses and their contribution to nitrate within the watershed are one of the sources of highest potential reduction due to management practices. The County, the SCCRCD, Camp, Dresser & McKee and Balance Hydrologics have produced documents that contain simple and cost effective recommendations to reduce nitrogen loading from equestrian facilities and trails to ground and surface waters.

Areas where animal wastes are concentrated and left untreated on the surface elevate nitrogen and pathogen levels. This happens through runoff and percolation, especially with the "first flush" of stormwater. According to some studies, horses and horse facilities are one of the principle causes of elevated nitrogen and pathogens within the watershed (Camp, Dresser, & McKee; White & Hecht, 1994; County of Santa Cruz, 2001). Other confined animals such as dogs, cats and chickens also increase nitrate and pathogen pollution.

3.7.2.c Pathogens

Bacteria, virus, giardia, cryptosporidium, and other pathogens can make water unsafe for swimming, as well as require more expensive treatment for drinking water. Most testing for pathogens involves testing for indicator bacteria that would suggest the presence of pathogens from sewage, fecal contamination, or other contamination (County of Santa Cruz, 2001).

While indicator bacteria themselves do not necessarily cause illness, their presence causes warning signs to be posted at beaches, and significantly impacts recreational opportunities.

Sources of pathogens and indicator bacteria are non-point source urban runoff, failing septic systems, sewer system leaks, pet waste, livestock, feral pigs, encampments, and waterfowl. In natural settings, pathogens percolate into the soil where microbial organisms naturally decompose them.

The Watershed Sanitary Survey for the San Lorenzo and North Coast Watersheds (Camp, Dresser & McKee, 1996) found low to moderate levels of coliform bacteria in the tributaries of the San Lorenzo River, such as those that supply surface water to the District. These low levels result from the lack of development and the large areas of intact open space upstream of the water uptakes.

Domestic and commercial wastewaters potentially contain a number of pathogenic microorganisms that can cause diseases such as hepatitis, typhoid, cholera, dysentery, salmonella, giardiasis, and cryptosporidiosis (Camp, Dresser & McKee, 1996). Incompletely treated effluent may reach groundwater supplies or streams from an improperly functioning septic system. However, a properly functioning septic system will remove these pathogens within a short distance by microbial action in the soil.

The Department of Health Services (DHS) requires disinfection to treat pathogenic organisms, at all surface water treatment plants. If water supply sources are found to contain high levels of total coliform, DHS may increase the minimum disinfection requirements for that plant.

Sources of pathogens

The highest levels of indicator bacteria are consistently observed in more dense urban areas such as Scotts Valley and Santa Cruz, indicating that urban runoff and leaks in sewer systems, rather than septic tanks, are the main cause. As the river flows out of suburban areas and through State Parks or other low-density areas, bacteria levels drop substantially as stream flow picks up speed, and natural ecological processes take effect. After passing through the gorge, the river flows through the channelized and heavily developed area of downtown Santa Cruz. Here the river is subject to all the key contributors of pathogens: urban runoff, sewer leaks (within permeable alluvial soils), trash, pet wastes, homeless encampments, water fowl and general non-point human pollution. The river mouth continues to have high bacteria levels and is permanently posted as unsafe for swimming.

Urban runoff can be a source of fecal and total coliform bacteria in stream water. In an urban setting, non-permeable surfaces collect by-products of human activity, pet and animal wastes, and organic debris, holding them at the surface, until they are washed into streams by rain. Moderate to high coliform bacteria levels are frequently measured in the more urban lower San Lorenzo River (Camp, Dresser & McKee, 1996).

A vast majority of residents in the watershed are on private, individual septic systems. An estimated 14,000+ individual onsite septic systems exist in the 138 square miles San Lorenzo River watershed (County of Santa Cruz, 2000). Community sewer systems with treatment serve about 300 homes in the Boulder Creek Country Club, 30 homes in Rolling Woods, 54 homes at Bear Creek Estates, and the Mount Hermon Association (County of Santa Cruz, 2000). The Bear Creek Wastewater System is operated by the San Lorenzo Valley Water District. Both the Boulder Creek and the Rolling Woods wastewater systems are under the jurisdiction of the County Public Works Department (County of Santa Cruz, 2001). The Boulder Creek Country Club facilities have recently been upgraded and improved. All of these community systems including local schools are regulated by the Regional Water Quality Control Board (RWQCB).

The frequency of posting swimming areas in the watershed has also decreased significantly since the 1970s and 1980s due to the upgrading and improved maintenance of septic systems within the watershed. With improved management and monitoring summer bacteria levels have substantially improved, and the river generally meets all standards for safe swimming at all areas upstream of Santa Cruz (County of Santa Cruz, 2001).

The San Lorenzo and North Coast Watershed Sanitary Survey (Camp, Dresser & McKee, 1996) summarized the effects that the large numbers of septic systems have on coliform levels within the watershed:

> The absence of fecal coliforms in shallow groundwater underlying developed areas indicates that incidents of bacterial contamination of surface waters do not result from cumulative contamination of groundwater, but result from failures and discharges to the ground surface from individual systems. Rapid detection of failing septic systems under the Wastewater Management Program has anecdotally reduced the frequency of high microbial concentrations in the San Lorenzo River. The County found that human waste is not the primary source of fecal coliform in the San Lorenzo River based on fecal coliform to fecal streptococcus ratios. After many years of study, the County and Regional Board have concluded that the majority of existing septic systems do not consistently contribute significantly to the bacteria concentrations measured in the surface waters.

An evaluation of the County fecal coliform bacteria data, conducted by the County Health Services Agency, found no significant increase in bacteria in the swimming areas of the San Lorenzo River system.

Greywater systems are common throughout the San Lorenzo Valley and are often utilized to alleviate stress to septic systems with inadequate leaching capacity. Greywater systems collect and dispose of wastewaters originating from washing machines, showers and sinks. Although greywater contains fewer pathogens, solids and nutrients than toilet wastes it can still be a hazard to health and water quality.

According to the Santa Cruz County Environmental Health Services, bacterial concentrations in greywater from shower or bath water can reach 400,000 fecal coliforms and 3 million total coliforms/100 milliliter (ml). Washing machine wastewater can range from 2,000 to 10 million fecal coliforms/100ml. In addition, there are roughly 200 enteric virus/liter of undisinfected greywater from showers and baths and 3,000 viruses/liter from washing machines. County policy requires connection of all greywater to an adequately sized septic system but probably allows installation of at least 25 to 50 greywater sumps each year under appropriate conditions (Camp, Dresser & McKee, 1996).

A marked decrease in septic system failures has occurred since the time when the San Lorenzo Valley was being converted from summer homes to permanent residences. The Santa Cruz County Health Services Agency reported that, "Since 1986, the wintertime septic failure rate has declined from 5-14% to 1-3% depending on the area" (County of Santa Cruz, 2001).

Another source of pathogens is from equestrian trails, paddock areas, and manure stockpiles, which can contribute elevated levels of fecal coliform, Cryptosporidium, and other organisms (County, 2001). Other sources of pathogens are pets, livestock, waterfowl, decaying garbage, homeless encampments, sewage leaks, and general nonpoint urban pollution (County of Santa Cruz, 2000 & 2001). The potential for erosion from horseback riding and the introduction of fecal matter from horses may be significant, especially at stream crossings. However, the effect of horseback riding cannot be quantified separately from other sources which contribute microbial contaminants and turbidity/sediment (Camp, Dresser & McKee, 1996).

Homeless encampments near creeks may dispose of human waste directly into the streams. Even if latrines are dug, the encampments are often within the floodplain. Encampments effect riparian vegetation and concentrate trash. Homeless encampments directly elevate levels of sediment, pathogens, nitrate and particulate contaminants in streams.

3.7.2.d Toxic compounds

Toxic compounds include synthetic organic chemicals (SOCs); volatile organic compounds (VOCs), which include fuel, oil, gasoline, and MTBE; heavy metals, including lead, zinc and cadmium, pesticides, PCBs, oil and grease. The presence of toxic compounds in the San Lorenzo River has primarily resulted from discharge of VOCs from leaking underground storage tanks.

Drinking water aquifers in Scotts Valley and some other localized parts of the watershed have been contaminated by these toxic compounds, which has required discontinuance of wells and/or expensive treatment (County of Santa Cruz, 2001).

Past studies in the San Lorenzo River watershed have indicated low to nondetectable levels of heavy metals, pesticides, PCB's, oil and grease in the San Lorenzo River. There have been no documented impacts on organisms or beneficial uses of the River resulting from toxic constituents in urban runoff. Very low levels of only a small number of trace organic compounds (pesticides and PCB's) were found, at only 2-7% of the level considered hazardous (County of Santa Cruz, 2001).

Elevated levels of lead, zinc, and cadmium have been found, but none of the compounds were found at levels that are known to cause a threat to human or biotic health. Zinc and cadmium are

Writing by Dr. Thomas A. Ruehr
Professor of Soil Science, 2006

Water permeability problems in Baywood fine sand.

The wind blown sand associated with most of the Los Osos community is mapped as Baywood fine sand. The Natural Resource Conservation Service (accessed at http://soils.usda.gov/) describes this soil with the following properties: “Some pedons also have a few faint lamellae or a few small dark reddish brown concretions.”

The fine lamellae occur about every 2 to 4 inches. They are roughly parallel to the land surface. Although the total number have never been counted, hundreds to thousands exist with depth below the land surface. Each layer is finer than a pencil consisting of an accumulation of clay (5 to 7 % within the lamellae) and a coating of iron oxides both above and below each layer. The clays and iron oxides have partially filled the soil pores. The iron oxides have provided a weak cementing action allowing these lamellae to persist over time.

Because some of the soil pores are partially filled with clay and iron oxides, the ability of these pores to transmit water directly downward (vertically) is impaired. Each time a film of water contacts one of these lamellae, the water temporarily ponds on top of this layer. Under the influence of gravity, the temporarily ponded water moves laterally (sideways) down hill. Eventually the water will slowly move through this lamellae layer until it encounters the next layer. The same process is repeated at each layer.

The overall effect of these numerous parallel lamellae is to slow vertical water movement forcing more of the water to move downward in a stair step fashion with considerable lateral movement of water. This problem creates difficulties when trying to predict the rate of water permeability in these soils. Disturbed samples will have high water infiltration rates vertically because the lamellae have been mixed, but non-disturbed samples will have slower vertical flow with considerable lateral redistribution of water from the site of water application.

Water permeability rates for many of the soil sites in the Los Osos area underlain by the wind blown sands are overly exaggerated because this phenomenon has been ignored by most scientists. The lamellae enhance the filtration process because the water flow is impeded and more effective blocking of particles (clay, bacteria, viruses) occurs in the water flow path.

Baywood Fine Sands — Lamella Formation
As demonstrated by Dr. Thomas A. Ruehr
Professor of Soil Science, 2006

Emily Ayers emayers@lowimpactdevelopment.org

To: Keith Wimer <kwimer1@gmail.com>

Date: Fri, Oct 21, 2011 at 8:36 AM

Subject: RE: Seawater intrusion and LID

8:36 AM (1 hour ago)

Keith,

I'm very sorry for the extreme delay in responding to you. There's a growing movement to use LID to capture runoff from storms up to the 95th percentile. That would mean that it shouldn't be too hard to capture 95 percent of the stormwater falling on a site annually. The remaining 5 percent of runoff is from large storm events, and that is usually best handled using detention storage. I hope that's helpful.

I'm usually much better about getting back to people, unfortunately your email got buried.

Thanks,Emily Emily Mitchell Ayers, Ph.D.

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ACHIEVING A SUSTAINABLE LOS OSOS VALLEY WATER BASIN

Framework for a 21st Century basin management plan

September 2009 Draft

Prepared by Keith Wimer
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Executive Summary

Efforts to address seawater intrusion (SWI) into the Los Osos Valley Water Basin since the 1980's have failed to make significant headway. As a result, SWI has contaminated about half of the basin and permanently destroyed much of it. Recent tests and studies indicate SWI is accelerating, making the future of the basin uncertain.

The Los Osos Valley basin is the sole source of water for the community of Los Osos and an important source of freshwater for Morro Bay National Estuary and environmentally sensitive habitats in the areas. Although nearby communities have tapped imported water and desalinated water to back up supplies and help manage SWI, these options are not feasible for Los Osos.

Therefore, stopping SWI and establishing a sustainable basin is critical to the future of environmental, social, and economic systems in the area.

Achieving a Sustainable Los Osos Valley Water Basin outlines a plan to stop SWI within the next three years using an intensive water use efficiency approach, applying high-efficiency retrofits and integrating green and appropriate technologies (rainwater harvesting, low impact development, and graywater reuse).

The goal is to fully develop supplemental water sources as quickly as possible to stop the pumping causing SWI. These sources include conservation, rainwater, and graywater. Conservation is now widely considered the most cost-effective source of new water, while rainwater and graywater are becoming increasingly cost-effective. When compared to imported water and desalination—or the cost of delaying a solution to SWI—rainwater harvesting and graywater reuse become very attractive options.

Within two years, the plan allows 950 AFY of pumping to stop from the large lower aquifers where SWI is occurring, and 720 AFY to stop from the basin. These reductions are needed to maintain true basin "safe" yields. In keeping with sound environmental and sustainable development principles, the plan takes a precautionary approach to determine safe yields. It uses the most conservative estimates from recent basin studies and builds in margins of safety erring on the side of protecting a finite, threatened resource. Margins also prepare the basin for sea level rises and climate change uncertainties.

The total cost of the program is $12 million, about $2000 per household. Rebates, grants, tiered rates, and other incentives are expected to reduce plan costs substantially. All users of the basin will share plan costs based on current water use.

The plan's emphasis on integrated planning, water use efficiency, green and appropriate technologies, and beneficial reuse aligns with many California environmental initiatives and laws, as well as the priorities and policies of resource protection agencies and environmental groups, (e.g., Department of Water Resources, Regional and State Water Boards, and the National Estuary Program). Thus, the plan optimizes grant and special funding opportunities.

By maximizing strategies that directly reduce SWI, minimize delays, provide multiple benefits, enhance cost effectiveness, and optimize grant funding; the plan offers the fastest, surest, and most cost-effective way to achieve a sustainable Los Osos Valley Water Basin.

Introduction

Seawater intrusion (SWI) has been a serious problem in the Los Osos Valley Water Basin since the 1980's. In 1992, the San Luis Obispo County Board of Supervisors declared a Level II of severity for resource deficiency recognizing SWI was threatening the basin. In 2007, the Board elevated the alert to a Level III after learning seawater had moved inland since the 1970s permanently destroying much of the basin. Recent tests indicate SWI may be accelerating and the latest studies suggest the basin could be lost unless the pumping causing SWI stops in the near future.

Since the 1980s, basin studies have recommended strong conservation programs to address SWI. However, the programs have never materialized. The *Urban Water Management Plan* in 2002 was the closest the community came to a comprehensive plan (Wallace & Maddaus). However, the plan relied on water purveyor agreement to a mandatory program (still not achieved), and it failed to offer a basin-wide solution, also setting conservation targets too low to stop SWI.

This plan explores the potential of an intensive, comprehensive basin-wide conservation program, maximizing the use of the latest high-efficiency retrofits, and integrating low impact development (LID), rainwater harvesting, graywater reuse, and beneficial use of recycled water.

Consistent with 21st Century resource management, it takes a proactive and precautionary approach to the management of a disappearing, finite resource building a margin of safety into basin safe yields. Although recent studies suggest SWI can eventually be stopped by shifting pumping to other locations in the basin, this plan offers a quicker, more certain and cost-effective way to stop the pumping causing SWI. Thus, it increases the chances of basin sustainability.

Current Per Capita Water Use and Reduction Targets

Current Per Capita Use

Average indoor use in Los Osos is approximately 60 gallons per capita per day (gpcd). This is lower than estimated in the Los Osos Wastewater Project (LOWWP) *Fine Screening Report* and *Technical Memorandum: Flow and Loadings* (66 AFY gpcd) but consistent with the 2002 Pacific Institute landmark study on California water use (*Waste Not, Want Not*) and EPA-sponsored studies by Mayer, et al, in 2003 and 2004. Additionally, the *Fine Screening Report* and technical memoranda base estimates on Los Osos Community Services District (LOCSD) monthly totals, which include non-residential use and assume no outdoor use from December through March (unlikely in Los Osos). Based on studies of other coastal communities, the plan assumes average outdoor use is one-half indoor use, or one-third of total use, 30 gpcd.

Residential Indoor Targets

Gleick el al. in *Waste Not, Want Not* estimate average water use per capita in California can be reduced from 60 gpcd to 37 gpcd without inconveniencing water customers. This is achieved by retrofitting homes with indoor water-saving fixtures and appliances (water-efficient toilets, washers, dishwashers, shower heads and faucets), also fixing leaks (Gleick et al.). Studies by Mayer et al. confirm indoor retrofits can cost-effectively reduce water use to around 40 gpcd,

with the high-efficiency fixtures and appliances receiving high satisfaction ratings from customers (2003, 2004).

Since 2004 (i.e., when Gleick and Mayer completed their studies), high-efficiency fixtures have gotten more efficient maintaining similar approval ratings (Gauley, Veritec & Keoller). The Mayer et al. studies used ultra low-flow (ULF) toilets (at about 1.5 gallons per flush—gpf); while the latest high-efficiency toilets (HETs) use under 1.28 gpf. At least one toilet on the market, a Caroma Smart 305 dual-flush, uses of about 1 gpf on average (.8 gpf/1.28 gpf) (see http://www.caromausa.com/smartRFP and EPA *Water Sense* website).

Substituting the Caroma Smart toilets for the low flow models in the Mayer studies reduces total water use to under 40 gpcd. This assumes an average of about five flushes per day per person (USEPA *Water Sense*). Therefore, this plan's basin basic retrofit package (without high-efficiency clothes washers) reduces conservation to under 45 gpcd (Mayer et al., 2003 & 2004). The plan sets a target of **45 gpcd** for the basic retrofit package (two high-efficiency toilets, low-flow showerheads, faucet aerators, leak repairs, and water auditing services).

Homeowners can also chose from a supplemental package of hotwater recirculators, high-efficiency washers, and toilet-lid sinks if the options achieve greater water savings for the cost. For instance, a homeowner might decided to keep 1.6 gpf toilets, instead choosing a hotwater recirculator or high-efficiency washer—if benefits are greater. As with toilets, the latest front-loading washers are more efficient than models used in the Gleick et al. and Mayer et al. studies, (about 18 gallons per load (gpl) for a full-size washer—per a phone conversation with a sales representative at Idler's Appliances in San Luis Obispo, November 19, 2008). Gleick and Mayer studies assume 22-24 gpl for high-efficiency washers.

Water auditors and program incentives (e.g., rebate schedules) would encourage homeowners to selected options with the greatest benefits. Effective design and application of program incentives could allow the program to exceed plan targets (e.g., achieve an average of 40 gpcd).

(Note: Some people have expressed concern that property owners receive different benefits under the plan. If grants covered most homeowner costs these concerns would obviously be minimized. Allowing indoor allotments to go towards outdoor is an option. One person suggested $300 rebates to recognize people for proactive conservation. Also, education on the plan's general benefits (e.g., long-term water and wastewater cost reductions) should reduce concerns.)

Residential Outdoor Targets

The plan's outdoor potable water use target is 15 gpcd (50% of the current 30 gpcd). It is achieved with xeriscape, graywater reuse, and rainwater harvesting. Gleick et al. indicate xeriscape can reduce water use up to up to 50% with installation of drip systems and up to 80% with plant selection, while rainwater and/or graywater systems can eliminate potable use altogether (pp. 71 & 73). Since rainwater and graywater recycling systems provide new (or supplemental) outdoor water source, they can allow total outdoor use to remain at, or near, current levels.

Residential Potable Water Use Reduction Targets

Indoor reduction 25% (from 60 gpcd to 45 gpcd average)
Outdoor reduction 50% (from 30 gpcd to 15 gpcd average)
Total reduction 33% (from 90 gpcd to 60 gpcd average)

Basin-wide Use and Targets
(All calculations rounded to the nearest 10 AFY)

Multiplying the above estimates by 14, 351 (the population of Los Osos per the 2000 census) indoor basin-wide use currently is about 960 AFY, outdoor use about 480 AFY, and total indoor-outdoor use is about **1,440 AFY**. Applying conservation targets, puts total use is **960 AFY**—a reduction of 480 AFY.

According to recent technical memoranda by Cleath-Harris Geologists, total water use in the basin is currently about 3150 AFY, broken down as follows: 800 AFY for farms, 200 AFY for private domestic (i.e., private wells), 100 AFY for Sea Pines Golf Course, and 2040 AFY for urban use. Excluding Sea Pines and farm use, the total use is about **2240 AFY**. (This plan assumes all water use reductions for farms and Sea Pine Golf Course will be from recycled water use with the LOWWP is on line.)

The difference between 2240 AFY and the 1440 AFY is about 800 AFY, accounted for by 1) higher than average residential use, 2) Class II use, and 3) leaks.

Per the Cleath-Harris studies, private residential properties with wells use about 200 AFY. These and other large properties (one-half acre or more), without and without wells, undoubtedly exceed outdoor water use averages. Additionally, homes in the Sunset Terrace neighborhood are likely to exceed averages. Water use in Sunset Terrace is not metered and most homes have large landscaped yards with lawns. (Note: The SLO Planning Commission recently added a condition to the LOWWP requiring all property owners connecting to the wastewater project to have water meters. This will help lower Sunset Terrace use.)

Schools (four in the area) likely add significantly to the 800 AFY due to heavy outdoor use. According to the *Urban Water Management Plan* outdoor Class II use is 20% of total use and irrigation is 85% of that (Wallace & Maddaus, Figures 3-7 & 3-9). These estimates are based on purveyor data and the *Residential End Users of Water* study published in 1999 by the American Water Works Association Research Foundation. This plan sets a 20% reduction target for Class II indoor use (less than for residential use, 25%), but it assumes all outdoor irrigation (75 AFY) will be with recycled water.

Finally, leaks will be a significant percentage 800 AFY of use. Most homes in Los Osos were built prior to 1980 and have aging plumbing. While the LOCSD recently replaced and upgraded its distribution system, this could cause more on-lot leaks due to increased water pressure. This plan addresses only the leaks on private property. However, water auditor inspections may help locate leaks in utility lines.

The plan assumes the 800 AFY of water use not included in residential estimates originates and can be reduced as follows:

1. *Above average outdoor residential use—250 AFY (with 200 AFY on large parcels and 50 AFY on average-sized parcels)*
    - 50 AFY on average-sized parcels will be eliminated as residents meet the plan's outdoor targets
    - 100 AFY on large parcels will be reduced by 50% (50 AFY) with outdoor strategies
    - 100 AFY on large parcels will be replaced with recycled water when it's available
    - Total reduction: 100 AFY initially (40% of 250 AFY) and 200 AFY total with recycled water (80% of 250 AFY) (Note: The outdoor use for large parcels included in earlier estimates is assumed to be insignificant, i.e., under 4 AFY).
2. *Class II use—450 AFY*
    - 360 AFY (indoor use) will be reduced by 20% with indoor strategies (70 AFY)
    - 90 AFY (outdoor use) will be reduced by 85% (75 AFY) and all of this will be replaced with recycled water when the LOWWP goes on line
    - Total reduction: 145 AFY
3. *Leaks —100 AFY (about 10% of indoor residential use)*
    - 100 AFY will reduced by 65% (65 AFY)

Current Basin-Wide Use (excluding Sea Pines GC and farm use)

Indoor residential = 960 AFY (60 gpcd x 14, 351)
Outdoor residential = 480 AFY (30 gpcd x 14, 351)
Above average outdoor use = 250 AFY
Leaks **=** 100 AFY
Class II (non-residential) = 450 AFY
Total Basin wide use = 2240 AFY

Targeted use and reductions (reductions in parentheses)

Indoor residential = 720 AFY (240 AFY)
Outdoor residential = 240 AFY (240 AFY)
Above average use = 150 AFY (100 AFY)
Leaks **=** 35 (65 AFY)
Class II = 375 AFY (70 AFY)
Total Basin wide use = 1500 AFY (715 AFY)

Total reduction from indoor-outdoor strategies = ***715 AFY***

Sustainable Yields

The plan takes a precautionary approach to basin safe yields, using low estimates from earlier studies.

The 2009 Cleath-Harris technical memoranda indicate the lower aquifer "sustainable" yield in the Urban Compartment is 620 AFY (p. 6). The 2007 *Resource Capacity Study* (RCS) reports the safe yield for the upper aquifer in the Urban Compartment is 1150 AFY, and the RCS estimates the total yield for the Creek Compartment is 800 AFY (SLO, p. 9). The two RCS estimates are taken from the 2002 Cleath & Associates safe yield study. Based on these estimates, total basin safe yield is 2570 AFY.

This plan also adds margins of safety to these "safe yields," reducing the upper and lower aquifer yields in the Urban Compartment by 50 AFY and 70 AFY respectively. It assumes 800 AFY is a safe yield for the Creek Compartment. This leaves a sustainable basin yield of **2450**. (Note: The LID recharge strategies provided in the plan add an additional margin of safety—see Appendix E "Basin Balance")

Based on the 2009 Cleath-Harris memoranda and the 2007 RCS, approximate current production from the lower aquifer in the Urban Compartment is 1500 AFY, from the upper aquifer in the Urban Compartment is 800 AFY, and from the upper and lower aquifers in the Creek Compartment is 850—or **3150 AFY** total current yield. Thus, current yield is about 700 AFY over sustainable yield.

Estimated Sustainable Yields vs. Current Yields

SY Urban Compartment Lower Aquifer = 620 AFY (w/ margin of safety 550 AFY)
SY Urban Compartment Upper Aquifer = 1150 AFY(w/margin of safety 1100 AFY)
SY Creek Compartment = 800 AFY
SY Total = 2450

CY Urban Compartment Lower Aquifer = 1500 AFY
CY Urban Compartment Upper Aquifer = 800 AFY
CY Creek Compartment = 850 AFY
CY Total = 3150

Overall reduction needed for a sustainable basin = 700 AFY
Lower aquifer reduction needed for a sustainable basin = 950 AFY

Plan Description and Costs

Residential Indoor Strategies

***Water auditors*:** Professional water auditing services are important to the success of this plan for a few reasons. First, the plan is meant to be implemented within a year to have maximum impact on SWI and to save as much of the basin as possible. Auditors can help ensure 100% implementation and optimal use of funding to achieve goals. By meeting with property owners one-on-one, they reduce or eliminate the need for time consuming surveys and promotional

programs. They ensure every homeowner understands the reasons for the program and the best options for achieving water reduction targets. They can also provide feedback from the field allowing the program to adapt and continuously improve based on actual conditions.

Jamie Lein, Conservation Manager for the Atascadero Mutual Water Company, shared her insights on the program she administers in a recent phone conversation. She said studies consistently show auditing services reduce community water use by 20%. She indicated Atascadero Mutual auditors identify leaks, fixing some on site, and also assist customers with water-saving options. Jamie related that an important function of auditors is customer relations. She said homeowners like the personal service, respond positively to water-saving suggestions, and develop a positive attitude about the water company.

Jamie estimates auditors at Atascadero Mutual complete about five audits per day and the average cost per audit is about $150. This covers the company's costs for wages, training, and other expenses (phone conversations October 23 and December 8, 2008).

***Leak Repair**s:* Studies by Gleick et al. and others (e.g., the AWWARF study, 1999; Mayer et al. 2003 & 2004) point out that most leaks can be repaired inexpensively by adjusting fixtures, appliances, and connections, rather than replacing them. They also note the majority of leaks occur in toilets (replaced in this plan) and are concentrated in a relatively small percentage of homes (AWWARF, Gleick, et al.). For these reasons, $100 per home is allocated for leak repair, about $600,000 total ($100 x 6000 homes).

***Indoor retrofits*:** The plan's basic retrofit package (two dual-flush HETs, low-flow shower heads, low-flow faucet aerators, leak repairs, and auditing services) provides the maximum water savings for the cost (Gleick, et al., Lean, Mayer et al.). The plan's supplemental indoor package includes hotwater recirculators, front-loading washers, and toilet lid sinks.

Purchased in bulk (i.e., orders of $6000 or more) a Caroma 305 Smart dual-flush toilet costs about $150 (for a round front model) (see Appendix D). This plan assumes the costs of low-flow shower heads and aerators for a typical home are about $50 total, based on the cost of the showerheads offered through Real Goods at $12 (www.realgoodscatalog.com).

The cost for installing the basic package is about $300, plus $50 for disposal of old toilets (per a conversation with a sales rep at Home Depot in San Luis Obispo). (Note: The installation estimate is for a retail customer having two toilets installed; bulk rate installation is likely to be less. The estimate does not include travel costs, assumed to be incidental if installers perform several installations at a time.). Installation of shower heads and aerators is assumed to be by homeowners or included in toilet installation costs. **Thus, the total cost of the basic retrofit package for this plan is $1000 ($ 700 for two toilets, low-flow shower heads, and faucet aerators, including installation and old fixture disposal; $150 for auditor services; $100 for leak repair; and a 5% contingency).**

The cost of a hotwater recirculator is about $200, with professional installation assumed to be about $200, for a total of $400. The cost for a toilet-lid sink is $89 (plus tax and shipping), with professional installation not required (www.realgoodscatalog. com). The cost of high-efficiency washers range from about $600 to $1500 (http://shopping.yahoo.com). In consultation with water auditors, homeowners may decide to install one or more of these options to achieve plan

targets. Depending on how the plan is administered (i.e., funding distributed), some customers might implement these to exceed targets.

Residential Outdoor Strategies

Outdoor strategies include the full range of xeriscape techniques, rainwater harvesting systems with tanks, LID systems (also referred to in this plan as rainwater earthworks systems), graywater systems, and an integrated xeriscape-LID-graywater system.

Water auditors (provided as part of the indoor program) will assess outdoor water use, fix (or arrange repair of) leaks, and explain program options. The plan allots an average of $1000 per household for outdoor strategies. The money would be spent (as with indoor strategies) to achieve plan targets as effectively as possible (i.e., 15 gpcd average outdoor residential use).

(Note: The $1000 allotments won't cover the full cost of several of the options presented here. Thus, effective use of education, grants, rebates, water pricing and other incentives are important. On the other hand, outdoor options provide multiple benefits (e.g., attractive, low maintenance landscaping) adding value for homeowners. They also provide mitigation options for the LOWWP, i.e., for on-lot impacts (pipeline installation, removal/decommissioning septic tanks, etc.) and for reduced groundwater flows to sensitive ecosystems. Recognizing potential impacts to ecosystems, the Planning Commission added a project condition to encourage property owners to direct rain gutter downspouts to abandoned septic systems for groundwater recharge. Several of these outdoor options provide environmentally superior solutions. In addition to providing recharge, the LID/earthworks and integrated LID-graywater systems reduce water and energy use with gravity-flow irrigation. They also provide cleaner recharge. Septic systems tend to concentrate pollutants and they percolate runoff closer to the groundwater increasing chances of pollution. LID systems filter and treat runoff and graywater near the surface where it receives greater natural treatment before it percolates (Asano et al.). Storing graywater in a septic tank may not be allowed for health reasons, and to use rainwater in a septic tank requires a pump, adding to costs—see below system cost comparisons.)

***Xeriscape*:** The full range of strategies can be applied (e.g., native and drought tolerant plants, moisture retaining soils and mulches, maintenance and care techniques, drip irrigation and timers, low-flow hose nozzles). The California Department of Water Resources "Landscape Water Use Conservation Methods" are provided in Appendix A.

Reducing outdoor use to 15 gpcd and assuming two people per household in Los Osos, allows 30 gallons per day for outdoor watering (210 gallons per week or about 850 gallons per month). (Note: Two a people per household is a conservative estimate—the 2000 Census estimates 2.4 per household and the 2000 *Urban Water Management Plan* estimates 2.6 per household. The latter would allow almost 1100 AFY of use per month.)

Per the 1995 *Graywater Guide* published by the California Department of Water Resources (CDWR), 210 gallons per week irrigates about 1000 square feet of "low water using" vegetation and 600 square feet of "medium water using" vegetation (CDWR). These square footages represent plant canopies or total plant coverage. The most common lot size in Los Osos is 50 feet by 125 feet, or 6250 square feet, with house, garage, and driveway taking up about half. This leaves about 3000 square feet, much of which is typically covered with patios, walkways, and

non-vegetative landscaping (e.g., rock gardens). Thus, "low water using" vegetation covers about one-half of an average-sized yard and 100% of the other common lot size in Los Osos, 25 feet by 125 feet).

My lot is 50 feet by 125 feet. I have about 75 plants in the backyard, 75% of which are drought tolerant. I currently use about 75 gallons per week watering with a standard drip system. If I double the amount to include the front yard (not yet planted), I'd be using under 30 gallons per day. Therefore, landscaping with mostly drought tolerant plants allows me (and most Prohibition Zone homeowners) to meet outdoor targets.

Because lawns are particularly water intensive, as well as fertilizer intensive, replacing them (and other water/chemical intensive landscaping) is important to basin sustainability. Plan incentives would focus on encouraging homeowners to plant native and drought tolerant plants.

Based on estimates for the xeriscape-rainwater-graywater system below, the $1000 allotment per home should cover professional installation (i.e., landscaping materials and installation) for at least the front yards of most homes.

***Graywater Systems**:* Graywater (and rainwater) systems extend and supplement outdoor water supplies, allowing homeowners to meet targets without substantially reducing total outdoor use. Graywater use also reduces wastewater flows, so it reduces the energy, chemicals, and costs to pump and treat wastewater.

Recent legislation (AB 1258—Lowenthal), and related changes in California Plumbing Code, modified graywater laws in California making it easier and less expensive to install basic graywater systems. This plan focuses on the two types of systems not required to have permits: clothes washer and single fixture systems (or fixtures to a common drain).

A clothes washer system can provide 10 to 30 gallons per day (gpd) for a two-person household depending on the efficiency of the washer (Asano et. al., Gleick et al., Mayer et al.). This allows homeowners to use between 40 and 60 gallons per day outdoors, still meeting plan targets for potable use. This is much more than needed typically for low water using landscaping and should support a yard with medium water using landscaping (see "Xeriscape").

Shower systems will provide about 20 gpd for a two-person household, so installing a washer and shower system should provide enough to water at most homes to maintain current total outdoor water use (Mayer et al., 2003).

Pumps cannot be installed in non-permitted systems. Therefore, washers and/or showers have to be located so that water can flow by gravity to landscaping (see the Appendix J for a complete list of conditions required for installation). Also, shower system installation, in most cases, requires homes to have raised foundations allowing access to plumbing (although sinks might be a good source of graywater in homes with slab foundations).

Assuming a washer is in a suitable location, professional installation is assumed be under $1000 for connecting lines and creating mulch basins or covering lines with 2" of mulch (as required by code). This would include materials and professional installation. Installing a shower system (or

connecting to another source) may add costs depending upon conditions. These estimates are based on estimates for the integrated xeriscape-rainwater-graywater systems below.

***Rainwater Harvesting Tank Systems**:* An average roof in Los Osos can provide about 10,000 gallons of water per year with 12 inches of rain (HUD, Lancaster). Average rainfall in Los Osos is 16 inches (Yates and Williams). Therefore, the potential for these systems to provide water for outdoor us is limited only by system capacity.

Loomis Tanks, in Arroyo Grande, sells a complete 300-gallon gravity-flow rainwater system for about $800, which can be expanded by increasing tank size (see Appendix B). A 1500 gallon system from Loomis costs about $1300, and a 2500 gallon system about $1800. These attach to rain gutter downspouts, and most homeowners should be able to install them.

A 2000 gallon gravity system installed professionally costs about $3200, and the same system with a pump installed professionally is about $4400 (see Appendix C). Combining a 2000 gallon system with xeriscape allows homeowners to comfortably meet plan goals while also having some high water using landscaping (e.g., small lawns) or water for other outdoor uses, e.g., (fountains and fire safety).

Having space for rainwater storage onsite pose a challenge for some homeowners in Los Osos; however, several solutions exist. When homeowners connect to the wastewater system, they might be able to retain existing septic tanks using them as cisterns (usually 1000 gallon capacity). Homeowners can also have an underground tank installed. A complete rainwater filtering and pumping package for underground tank/cistern systems costs $1699 (http://www.rainharvest.com). "Pillow" tanks are also available, which can be installed below decks and in crawl spaces. These are available from several companies and cost about $4000, with at least one company, Rainwater Collection Solutions, Inc., providing complete do-it-yourself installation instructions on line (http://www.rainwaterpillow.com/).

Rainwater Harvesting with Earthworks/LID: This plan does not distinguish between earthworks systems (described in *Rainwater Harvesting* by Brad Lancaster) and low impact development (LID).

Rainwater Harvesting provides a complete list of earthwork/LID strategies including berms, basins, terraces, vegetated swales, and French drains. The systems are designed to capture, retain, and percolate rainwater onsite. The sandy soils of Los Osos allow most rainwater to percolate. However, during storms rainwater falling on roofs, driveways, and other impervious surfaces often collects, runs off properties, and pollutes surface waters, e.g., Morro Bay Estuary. Earthwork systems provide multiple benefits. They retain stormwater onsite, provide moisture and nutrients to plants and trees, create attractive landscaping features, filter and treat rainwater via natural processes (e.g., microbial action in soil), and promote groundwater recharge (Lancaster).

Earthworks/LID systems can reduce water use in Los Osos by enriching the sandy soil with organic materials (mulch) allowing it to retain moisture longer extending the benefits of the water. They'll help maintain vegetation and trees in the area when septic systems go off line and they'll support sensitive ecosystems with freshwater flows. The systems will also protect and improve ground and surface water by recharging aquifers with clean rainwater, diluting and

washing pollutants from the soil, and preventing stormwater runoff. For these reasons, earthworks/LID systems are particularly important for a sustainable basin.

Michael Ogden, of Natural Systems International, author of the 2001 *Los Osos Drainage Feasiblity Report,* (in a phone conversation on February 12, 2009), said the sandy soils of Los Osos are well suited to enhancing recharge with natural systems, such as earthworks and LID systems. Calculating recharge from the systems, he said, is simply a matter of calculating impervious surface area and rainfall. Therefore, assuming a standard lot is 50' x 125' (6250 sq. ft. or one-seventh of an acre) and impermeable surface is 50% of the lot (roofs, driveway, decks, patios, etc.)—approximately 2500 homes with earthworks/LID systems will recharge over 200 AFY of water (7 homes/acre x 50% x 1.3 feet of rain per year). Of course, the impervious surface on some small lots cover even more than 50%, so the run off from 2500 homes likely to be more than 200 AFY in Los Osos. (See "Community Rainwater Harvesting/LID" for further calculations of potential recharge.)

A $1000 allotment for outdoor strategies will pay for materials and professional installation based on the integrated xeriscape-rainwater-graywater system estimate below.

***Integrated Xeriscape-Rainwater-Graywater Systems*:** Josh Carmichael of Carmichael Environmental designs and installs earthworks/LID systems on all scales (onsite and community). One is a combined xeriscape-earthworks/LID-graywater system (see Appendix I for illustrations).

By integrating three systems, this option multiplies benefits. It reduces water use with low water using landscaping. It captures, cleans, and percolates stormwater runoff, and it provides year-round irrigation for plants with graywater. As a result, it can potentially eliminate all outdoor potable water use, especially if two graywater sources are used.

Also, maximizing the benefits graywater systems requires occasional flushing to avoid clogging and mineral build up in the soil. These combined systems provide the service free of charge when rainwater enters the system.

Josh estimates integrated systems will cost from $500 to $1000 for the earthworks/LID component of the system. This covers materials (perforated piping, organic soil amendments, drought tolerant plants, etc.) and installation (conversation, September 16, 2009). The cost of materials and installation for connecting a washer and/or common drain (e.g., from showers) to the system is assumed to be $500—for a total of between $1000 and $1500. Josh indicates systems would be large enough to cover the front yards of most Los Osos homes (i.e. provide front yard landscaping).

Of all outdoor options in the plan (possibly all plan options)—these provide the greatest benefits for the money—for both the basin and property owners. Thus, they offer best value.

<u>Summary of Residential Costs (Without Cost Reductions)</u>

Indoor strategies = $1000 per household average or $6 million total ($1000 x 6000 households)

Outdoor strategies = $1000 per household average or $6 million total ($1000 x 6000 households)
Total for both programs = $2000 per household average or **$12 million**

(Note: Six thousand is a conservative estimate of households and costs. It rounds off the 2000 Census figure of 5,892. Also, the number includes many households living in multifamily units or mobile home parks requiring fewer retrofits and outdoor measures.)

Class II Applications and Community Rainwater Harvesting/LID

Class II Strategies

The $12 million funding is assumed to be sufficient to achieve Class II water use targets (for schools, institutions, and industry) for the following reasons: 1) cost savings due to effective use of grants, rebates, tiered rates, and ordinances, 2) the likelihood many residential users are already meeting targets (e.g., outdoor targets due to small lots), and 3) the likelihood high water use is concentrated among a relatively small number of water users.

Targeting Class II reductions are important to the plan due to their relatively high water use and potential water savings. Gleick et al. found the greatest potential for outdoor water conservation to be among Class II users, and the Association for Water Efficiency (AWE) reports that retrofitting Class II customers provides the greatest reduction. Furthermore, rebates for Class II users are often more generous than for residential customers, e.g., CUWCC commercial toilet rebates are $400 each versus $100 each for residential toilets.

Community Rainwater Harvesting/LID Strategies

Plan funding can go to installing community rainwater harvesting/LID systems. Strategically placed in a passive stormwater LID network, these will provide considerable benefits at very low cost. Josh Carmichael estimates that a landscaped bioretention (LID) system constructed over several blocks of the undeveloped Pismo Street would cost about $10,000 (conversation, December 11, 2008). The system would prevent pollution of the Third Street Marsh and Morro Bay Estuary while providing freshwater flows to these ecosystems. Thus, it would help mitigate for the LOWWP by maintaining groundwater flows post septic systems and by restoring habitat along the undeveloped right-of-way after project installation. It would also provide a community parkway (see Appendix H).

Community and neighborhood LID systems—especially when combined with onsite systems in an integrated plan—can substantially increase basin recharge and augment supplies to offset the pumping causing SWI. Because they are nature-based (e.g., move and treat water without using energy)—and provide multiple benefits, including stormwater control—they offer a cost effective way to help create a sustainable water supply.

For instance, a community LID system on the Broderson site (rather than leach fields for effluent disposal) provides the following benefits: 1) substantial recharge with clean rainwater 2) control of overland stormwater runoff before it becomes problem downhill, 3) additional habitat, open space, and passive recreational opportunities on the Broderson site. On the other hand, it avoids several negative impacts: 1) substantial initial and on-going impacts to habitat, e.g., from leach

field replacement, 2) significant construction and maintenance costs ($ 3 million for construction), 3) high energy use and cost (i.e., to pump water uphill to Broderson—$160,000 per year), 4) public concerns over soil destabilization and emerging contaminants entering groundwater (i.e., from recycled water discharged at the site) (Carollo, 2007, pp.2-11, 2-12 & Table A1).

A rainwater harvesting system—either tank or LID—at the Midtown site could capture and infiltrate runoff from the Highlands neighborhood—as well as restore habitat, beautify the area, and create recreational opportunities.

Installing LID systems (e.g., rain gardens) and/or underground tanks on 2nd Street in Baywood could stop the runoff now polluting the bay, and provide recharge and/or irrigate landscaping (e.g., at the two nearby inns). Currently, many acre feet of rainwater drain into the bay through culverts near the 2nd Street pier even in light to moderate rains.

A neighborhood LID system could also be installed to capture and infiltrate stormwater flowing into a concrete culvert at the west end of the Highlands neighborhood. The runoff eventually empties into the bay near Sea Pines Golf Course polluting the estuary. It could be infiltrated near the golf course or stored and used for irrigation (e.g., at the golf course or Monarch Elementary School).

The 2001 *Los Osos Drainage Feasibility Report* provides many practical suggestions for community/neighborhood rainwater infiltration systems. Although the report does not calculate the potential recharge from these systems, Michael Ogden of Natural Systems International, the author of the report estimates at least 500 AFY is possible if runoff from paved streets in Los Osos is collected. He said calculating recharge is a simple matter of calculating impervious surface area and multiply it by feet of rainfall. About 3000 AFY of rain falls on the Prohibition Zone (i.e., 1 ½ feet on about 2000 acres). With a run off coefficient of 50% for medium density neighborhoods (Yates and Williams, Table 4), theoretically, just the Prohibition Zone will provide 1500 AFY of water for recharge. As noted above, a good deal of rainwater in Los Osos percolates naturally due to the sandy soils (Yates and Williams). However, capturing rainwater from just one-sixth of the Prohibition Zone (e.g., areas where rainwater won't percolate due to high groundwater) provides 250 AFY of recharge. The runoff from the Highlands and Baywood neighborhoods currently polluting the estuary would likely provide 200 AFY of recharge.

This plan assumes a very conservative level of recharge from LID systems, 200 AFY. This can be achieved by either onsite or community systems. Applying both approaches provides 400 AFY of recharge close to the estimated recharge (or "disposal") at Broderson leach fields (448 AFY). Furthermore, LID systems can be located to maximize benefits on aquifers and ecosystems.

Urban Reuse and Ag exchange

Urban Reuse

One objective of this plan is to maximize the SWI benefits of recycled water from the LOWWP. The Regional Water Board, the California Coastal Commission, and the Los Osos Community Services District support this basic objective, and the Planning Commission added several

conditions to the LOWWP requiring recycled water to be used within the basin and prioritized to stop SWI. At the request of many agencies and organizations, the Commission also required tertiary treatment and disinfection to enable the beneficial use of the water for a range of urban and agricultural uses.

As discussed in "Basin-wide Use and Targets," this plan allots 75 AFY of recycled water to Class II use and 100 AFY to homes on large parcels with high outdoor use. Sea Pines Golf Course might also receive 100 AFY if a better source isn't available, and the *Fine Screening Report* indicates 50 AFY can be used for the cemetery. Thus, this plan assumes up to 325 AFY of recycled water will go to urban uses. The *Fine Screening Report* and *Technical Memorandum: Effluent Reuse and Disposal Alternatives* estimate urban reuse potential for the urban area to be only 60 AFY with another 50 AFY going to the cemetery. However, it includes only large urban users, e.g., schools. This plan assumes all Class II irrigation and much of the irrigation on large parcels will be with recycled water. Current California law requires recycled water to be used for outdoor purposes when it is available, so the assumptions are reasonable.

Recycled water will not be available until the LOWWP is complete (about four years) and this plan is designed to stop SWI within two years. Therefore, water for the above uses (e.g., outdoor irrigations for schools) should be pumped initially from the upper aquifer to reduce SWI and achieve the goal of reducing pumping from the lower aquifer by 1000 AFY within two years.

Ag Exchange

Ag exchange also maximizes the benefits of recycled water for stopping SWI. It provides a water source (ag well water) to reduce pumping causing SWI at the same time it reduces pressure on the aquifers underlying farmland in the basin (the Creek Compartment). It accomplishes the latter in two ways: First, recycled water is not exchanged at a one to one ratio. Farmers get more than they provide. Therefore, they will pump less groundwater under their farms. Secondly, treatment costs can be reduced if some of the nitrates and phosphates in wastewater effluent are left in the recycled water. Applying a nutrient-rich water source on ag lands decreases the use of nitrogen and phosphate fertilizers in the watershed reducing pollution of groundwater (and surface water). Ag exchange also reduces farm energy use for pumping groundwater (90% of the energy use and cost for farmers) and it reduces fertilizer costs. These considerable benefits provide strong incentives for farmers to participate in the program. This plan assumes farmers will take at least 300 AFY of recycled water by project start up (in about four years). A basin-wide plan with an ordinance directed toward stopping SWI will also help ensure implementation of the most effective beneficial reuse options.

Potential Cost Reductions

1) This plan's emphasis on integrated planning, water use efficiency, green and appropriate technologies and beneficial reuse optimizes opportunities for grants and other private and governmental funding and incentives (e.g., low interest loans).

The plan aligns with the goals and objectives of State and federal grant and funding programs (e.g., State and Regional Water Board programs) as well those of many environmental organizations, e.g., the National Estuary Program (see Appendices F and G).

Darla Inglis, director of the new, regional Low Impact Development Center, indicated at a public meeting in January of 2009 that grant funding is available for LID projects which mitigate for wastewater construction impacts. Grant application assistance is one of the functions of the new center.
(Note: LOWWP funding can be used as matching funds for grants. Also see Appendices F & G for grant programs and internet links.)

2) Effective application of rebates, tiered rates, plan promotion/education, and ordinances should achieve targets at less than half the estimated program cost.

3) Established rebate programs are available.
The California Urban Water Conservation Council (CUWCC) offers rebates for Best Management Practices (BMPs) many of which are called for in this plan, e.g., up to $100 for HETs and $200 for high-efficiency washers. PG&E offers rebates for front-loading washers. (Note: The County and water purveyors have to be CUWCC members to participate in the CUWCC program. Currently, Golden State Water Company is the member but it does not appear on the CUWCC list active participants in rebate programs—see http:// www.cuwcc.com/smartrebates-utilities.aspx.).

4) A relatively high amount of use or leaks on relatively few properties and a high number of inefficient fixtures (e.g., 5-7 gpf toilets) will allow the plan to meet targets at less than estimated costs.

5) Long-term O&M costs can be offset with "work trade" programs.
These programs would allow area residents to earn "water credits" toward payment of their water bills in exchange for helping to maintain community amenities such as rainwater harvesting/parkway features (conversation with Josh Carmichael, December 11, 2008).

Specific to LOWWP

6) LOWWP funding for yard and/or street right-of-way restoration and septic tank removal/disposal can go to this plan—also the $1million allocated for conservation.

7) Reduced wastewater flows should result in lower treatment facility construction costs.

(Also see Appendix G for innovative programs.)

Dividing Plan Costs

An important goal of this plan—and one reason for a basin-wide program—is to ensure costs are shared equitably. SWI is a basin wide problem and every stakeholder in the basin must be a part of the solution.

For the purposes of dividing and calculating costs, the following is assumed:

1. All costs for the plan (reduced by grants, rebates, and other means) are covered with funding sources other than water rates and charges.

2. Water rates and charges will cover on-going costs of the program, along with any shifting of pumping or any infrastructure changes that need to occur, i.e., calculations will not cover replacement costs or operational costs beyond the $2000 per household average to implement the program.
3. Costs will be equitably divided on the basis of current water use (e.g., Prohibition Zone residential), with farm use exempted.
4. Future development will not occur unless basin sustainability is achieved—so current property owners must cover all the costs of the plan (before LOWWP completion). If SWI stops, the basin is found to be sustainable, and recycled water use allows safe pumping of the basin to support development, then the next phase(s) of the plan in which recycled water is use would be paid for by future development (e.g., fees and assessments).
5. LOWWP funding may be used to cover Prohibition Zone property owners' costs. Other sources would be used to cover other property owners' costs, but LOWWP funding may be used initially to leverage grants and/or construct infrastructure that has basin-wide benefits.

The estimated cost of the program is $12 million without cost reductions. Assumed water use in this plan is as follows: 200 AFY for private domestic (i.e., private wells), 100 AFY for Sea Pines Golf Course, and 2040 AFY for urban use (2340 AFY total—not counting farm use). Based on population, Prohibition Zone use is 87 % of the total urban use (about 1770 AFY) with residential use about 1320 AFY and Class II 450 AFY (see "Basin-wide Use and Targets").

Therefore, a rough breakdown of costs by percentage of current use is the following:

Urban Residential Prohibition Zone = $*6.7 million* (1320 AFY/2340 AFY = 56%)
Urban Residential Non-Prohibition Zone = *$ 1.4 million* (270AFY/2340 = 12%)
Class II (including Sea Pines GC) = *$2.9 million* (550 AFY/2340 = 24%)
Rural Residential (with private wells) = *$1.1 million* (200 AFY/2340 = 9%)

Cost Effectiveness

Capital Costs of Plan Compared to Capital Costs for Imported Water and Desalination

This plan:
$16,670/AF ($12 million/720 AFY of supplemental water w/o LID)
$13,040/AF ($12 million/920 AFY of supplemental water w/ LID)

Imported water:
Nacimiento = *about $22,000/AF*
State water = *about $40,000/AF*

Desalination:
About 77,000 to $90,000/AF

The above capital costs for Nacimiento and state water are based on the LOWWP *Technical Memorandum: Imported Water* (pp. 12 & 17). They include capital costs, plus buy-in costs for state water. They do not include the cost of the imported water itself, which the TM states is

$1180/AF or about $.85million for 715 AFY. Desalination costs are based on the estimated $100 million capital cost for the Nipomo Project (from "The Cost to Quench Nipomo," *The Tribune,* December 18, 2007). The County *Resource Capacity Study* estimates on-going costs for desalinated water are $4000/AF, or $2.9 million per year for 715 AFY (2007, p. 12).

Studies focusing on indoor use (e.g., the 2003 Mayer et al. and 2008 Veritec & Koeller studies) conclude indoor retrofits (toilets, shower heads and washers) are cost-effective. The Gleick et al. study finds indoor and outdoor strategies, including leak repairs and outdoor "irrigation management measures" (i.e., xeriscape) to be cost effective when the cost of water is $580/AF or more (p. 118).

This plan integrates the strategies found to be cost effective in studies with green and appropriate technologies to reduce duplicated costs and add overall value. Besides reducing infrastructure, energy, and wastewater treatment costs; plan strategies provide water quality and quality of life benefits (e.g., landscaping and beautification). They also help mitigate for the LOWWP—all of which must be factored in to a cost analysis.

Finally, analyzing the cost effectiveness of any strategy for the basin requires factoring in how fast and certain it is to stop SWI. Imported water and desalination require costly infrastructure (subject to delays) and these water sources have proven unreliable locally and statewide. Shifting pumping to the upper aquifer or other parts of the basin requires infrastructure and may destabilize other parts of the basin. These uncertainties and high costs—added to the potentially disastrous consequences of delay—support the cost effectiveness of this plan.

Summary of plan benefits

Overall Benefits

1. ***Provides the best chance to save as much of the basin as possible, maximizing its chances for sustainability and preserving its benefits for this and future generations.***
2. ***Minimizes the chances of potentially severe (even catastrophic) environmental, social, and economic impacts if basin water supplies disappear***
3. ***Keeps water, wastewater, and energy costs as low as possible over the long term***
4. ***Protects and preserves sensitive ecosystems***
5. ***Increases the likelihood of a viable LOWWP***
6. ***Maximizes the beneficial uses of water sources***
7. ***Supports the health of the watershed***
8. ***Prepares for climate change impacts***
9. ***Provides the best chance for sustainable future development***
10. ***Provides residents many quality of life benefits***

Benefits to the LOWWP

11. ***Helps ensure impacts from the project are avoided or mitigated***
12. ***Increases opportunities for project grant funding***
13. ***Maximizes the effectiveness of project funding with integrated planning***
14. ***Ensures equitable sharing of costs for protecting and preserving the basin***

Conclusion

The serious SWI problem in the Los Osos Valley Water Basin won't be resolved with the same approaches applied in the past. In many ways the basin is a test case for sustainable development—whether resource planning and management can meet the complex environmental, social, and economic challenges society faces as resources dwindle. Intensive, whole-systems planning and a precautionary, proactive approach are needed to save this finite, threatened resource. Emerging technologies and best management practices combined, extended, and continuously improved from the field are needed to stop the trajectory of decline begun many years ago and to preserve the resource for many generations in the future. This framework attempts to provide such approach and practices to achieve a sustainable Los Osos Valley Water Basin.

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Los Osos Wastewater Project
California Coastal Commission Response Documents
Jan- May 2010

1. January 27, 2010 Transmittal Letter
2 Overall Project Site Plan, Los Osos Wastewater Project 2010
3 Treatment Plant Site Plan, Los Osos Wastewater Project 2010
4 Delineation of Jurisdictional Waters and Wetlands for the Los Osos Wastewater Project, Attachment G of Appendix G of the Los Osos Wastewater Project Environmental Impact Report, Michal Brandman Associates November 14, 2008.
5 Los Osos Wastewater Disposal Project Lupine Street Pump Station Los Osos, California Wetland Delineation Report, Morro Group June 14, 2004.
6 Los Osos Wastewater Disposal Project Treatment Plant Area Los Osos, California Wetland Delineation Report, Morro Group September 8, 2004 Los Osos Wastewater Disposal Project Treatment Plant Area Los Osos, California Wetland Delineation Report, Morro Group 8/9/04
7 Los Osos Wastewater Disposal Project 4th Street at Pismo Avenue Area Los Osos, California Wetland Delineation Report, Morro Group June 7, 2005.
8 7th Through 13th Streets Pump Station Wetland Boundary Determination, Morro Group 7/1/04
9 February 16, 2010 Transmittal Letter
10 January 26, 2010 email from Dan Cark to Mark Hutchinson identifying County assistance tasks
11 Copy of January 27, 2010 Wetlands Information transmittal letter
12 ESHA Mitigation response with attachments:
   - Los Osos ESHA Mitigation Requirements Table
   - Los Osos Wastewater Project, San Luis Obispo County, ESHA Impacts and Mitigation Map
   - Wastewater Facilities Project, Los Osos CSD, ESHA Impacts and Mitigation Map
   - Current Tri-W Site photos
13 Implementation Timing/ Water Conservation Program response with attachments:
   - Implementation and Timing of Conditions of Approval Table
   - SRF Program Water Conservation Requirements
   - Groundwater Basin Map
   - Effluent Re-Use and Disposal Tech Memo, July 2008 (part)
   - Coastal Zone Land Use Ordinance Section 23.04.184 (Water Efficient Landscape Ordinance)
   - Los Osos Groundwater Basin Retrofit Ordinances:
     i. Title 19
     ii. Title 8
14 Staging Areas on ESHA response with attachments:
   - Walker Aerial photos from 2003
   - Walker Aerial photos from 2007
   - Site photos from 2010
15 February 26, 2010 Transmittal Letter
16 Willow Creek response with attachments:
   - EIR Appendix D
   - Historic Wetland Aerial Photos
17 Hydrogeologic response with attachments:
   - Topical Response 8: The Broderson Leachfield
18 Septic Tank Decommissioning Response
19 April 16, 2010 Transmittal Letter with attachments
   - Overall Project Site Plan, Los Osos Wastewater Project 2010 revised 4.13.10
   - Treatment Plant Site Plan, Los Osos Wastewater Project 2010 revised 4.13.10
   - Andre Biological Constraints Map 4.13.10

must be identified to sustainably meet build-out demand and incorporated into an Estero Area Plan amendment prior to any connection to the project by new construction.

Broderson leachfields geology/hydrogeology: Percolation of treated wastewater in the Broderson area has been included in every project description for the Los Osos wastewater project since its inception in the 1980's. Over the course of the last 25 years, there have been dozens of studies and reports, completed by over 20 agencies and technical consultants, which have included evaluation of the Broderson area for percolation of treated wastewater. As a result, the geology and hydrogeology have been extensively studied and the specific conditions and responses are relatively well known.

- The underground conditions of sand and clay layers have been documented with test hole drilling.
- Soil tests to determine liquefaction potential have been conducted.
- Groundwater flow conditions under Broderson, and down-gradient, have been modeled.
- Perhaps most importantly, extensive pilot testing of two different percolation methods have been conducted to document soil percolation rates and underground water level response.

The extensive testing and analysis has led to a project description that avoids all potential adverse impacts from the Broderson leachfields, and is expected to provide multiple beneficial impacts.

The proposed project includes the use of the Broderson leachfields at half the rate (448 AFY vs. 896 AFY) than previously approved by the Coastal Commission for the LOCSD project. This is because the LOCSD included plans for harvest wells in low lying areas down-gradient from Broderson to remove up to 448 AFY to prevent high groundwater levels. Due to the uncertainty and inefficiency of the disposal of harvest water, and that the County is not a water purveyor, the County did not include harvest wells in the project description and correspondingly reduced the disposal rate at Broderson. The design and capacity of the Broderson site remains unchanged, thereby doubling the redundancy and factor of safety of the leachfields.

Based on this conservative approach, the potential for adverse impacts is even less likely and specific contingencies to identify when, where and how to address potential impacts would be speculative. However, the County has adopted the approach previously approved by the Coastal Commission for the LOCSD project and included the same requirements for a "Groundwater Level Monitoring and Management Plan" in the current project permit as condition #87.

An additional benefit of the "Groundwater Level Monitoring and Management Plan" for the proposed project is to evaluate the ability to increase the disposal rates at Broderson. The sea water intrusion mitigation benefits of the Broderson leachfields, which are centrally located in the high demand urban area, are expected to be greater

than agricultural irrigation reuse on the eastern fringe of the groundwater basin. Conversely, if the monitoring indicates that disposal rates at Broderson must be reduced, there is adequate capacity for agricultural irrigation reuse within the groundwater basin limits.

For more detailed discussion of the Broderson site and potential impacts and mitigations, refer to the attached discussion, titled “Topical Response 8: The Broderson Leachfield.” This discussion is from the “Response to Comments” section of the ~~Final EIR~~Final EIR, March, 2009.

2. County Authority

It is important to be aware that the Los Osos Wastewater Project has as its primary goal the elimination of water pollution from septic tanks. The focus of the project is compliance with the Regional Water Quality Control Board's discharge prohibition. By accomplishing this goal, the Project will remove a significant threat to water sustainability in Los Osos, and will remove a significant and ongoing source of environmental degradation.

It must also be noted that without the wastewater project, and specifically the recovery and reuse of recycled water included in it, there is no possibility that Los Osos can solve its water supply issues, either now or in the future. Placing recycled water at the Broderson site, replacing groundwater pumping for irrigation with recycled water, and mandating interior plumbing retrofits are indispensible elements of Los Osos' water future that are provided by the wastewater project. In addition, technical studies completed by the wastewater project clearly show that imported water options are not financially feasible for the community; managing existing groundwater supplies is the only viable option.

The County of San Luis Obispo is not a water purveyor for the community. Water is supplied by Golden State Water Company, the Los Osos Community Services District, S&T Mutual Water Company, and individual on-site wells. Consequently, the County has no direct authority to control groundwater pumping, set water rates, or establish penalties for excessive water use. Never-the-less, the County has and will continue to use all of its other authorities to positively impact the issue of water availability in Los Osos. Examples of County efforts include:

- The County has voluntarily remained involved in the current groundwater litigation between the water purveyors in order to positively influence the outcome for the citizens of Los Osos,

- The County has used its land use authority to adopt water efficient landscape ordinances (attached),

- The County has used its land use authority to adopt a retro-fit upon remodel ordinance, requiring the entire structure to upgrade to water efficient technologies (attached),

- The County has used its land use authority to adopt a retro-fit upon sale ordinance, requiring the entire structure to upgrade to water efficient technologies (attached), and

- The County has used its land use authority to require new development to retrofit enough existing homes and businesses to save twice the amount of water the new development would use (attached).

These previous actions demonstrate that the County is committed to using its authority to accomplish the necessary changes in the water use and supply equation in Los Osos.

3. Water Conservation Program

The focus of the water conservation program is to reduce seawater intrusion in Los Osos. Therefore, the conditions of approval describe a Program that includes elements that reduce pumping by reducing overall water use through mandated retrofits, provide recycled water in place of water pumped from the lower aquifer, provide a means to monitor water use, and provide for ongoing coordination with water purveyors.

The Water Conservation Program will comply with existing State policy contained in Section IX(C) of *Policy for Implementing the Clean Water State Revolving Fund for Construction of Wastewater Treatment Facilities*, *SWRCB*. Key Water Conservation Program elements in this policy are:

1. Water Survey Programs For Single-Family Residential And Multi-Family Residential Customers
2. Residential Plumbing Retrofit
3. System Water Audits, Leak Detection And Repair
4. Metering With Commodity Rates For All New Connections And Retrofit Of Existing Connections
5. Large Landscape Conservation Programs And Incentives
6. High-Efficiency Clothes Washing Machine Financial Incentive Programs
7. Public Information Programs
8. School Education Programs
9. Conservation Programs For Commercial, Industrial, And Institutional Accounts
10. Wholesale Agency Assistance Programs
11. Retail Conservation Pricing
12. Conservation Coordinator
13. Water Waste Prohibition
14. Residential Ultra-Low Flush Toilet Replacement Programs

1k. This approval authorizes . . . a water conservation program allowing a maximum water usage of 50 gallons per day / person for indoor water usage.

Condition 1k establishes the Water Conservation Program as part of the proposed project, and establishes a basic standard of 50 gallons per day per person indoor use. The indoor use standard is identified because it provides a direct nexus to the wastewater project: water used indoors directly impacts the size and operation of the collection system, treatment plant, and recycled water components of the Project.

email

Date: January 26, 2010
From: Dan Carl, California Coastal Commission
To: Mark Hutchinson, San Luis Obispo County
Subject: Los Osos

We have discussed internally, and have identified a number of tasks on which we need County assistance in order to address our Commission's concerns in the *de novo* permit review of the LOWWP. In particular, we have identified at least seven specific issues discussed by our Commission at the end of the hearing (as opposed to the four you have listed). We also note that while our lists are similar, the emphasis/expectation for how to address them appears to be a little different. To us it is clear that some of these things are multi-faceted and will probably not lend themselves to a 'one-item' response. And there are almost certainly going to be other things that come up in the course of addressing these things and the project under *de novo* overall that we'll need to address as they are fleshed out. That means that some of this is by necessity going to have to be iterative. Toward that end, we very much appreciate the offer of assistance in developing materials and supplemental analyses to help us address the various issues. To get started down that path, here are requests for assistance and/or next steps on the items that we identified thus far.

1. **Wetland delineation.** Please package a complete set of materials that include all wetland delineation reports for the project and send them to Jonna Engel in our Ventura office (89 S. California Street, Suite 200, Ventura, CA, 93001-2801). Please don't direct her to website links, but rather please provide her with actual documents. Please send a copy of the package to us in Santa Cruz. Please also obtain permission for CCC staff to enter onto private property to assess potential wetland areas. We will coordinate on field work dates once Jonna has had a chance to get into the documentation.

2. **Mitigation.** It is clear that we need to address the question of mitigation and the outcome for the balance of the Tri-W site (i.e., that portion of the Tri-W site not proposed to be used for pump station development) as part of this project. In particular, we need to be able to more clearly describe and account for the past habitat impacts at Tri-W, the proposed habitat impacts of the project, the proposed mitigation, and proposed restoration mitigation for any impacts at Tri-W not accounted for specifically by the project at the time of decision for the LOWWP. That could mean that this project include restoration/conservation of that area, or it could mean that County/CCC enforcement efforts conclude and account for restoration/conservation of that area, or some combination. The bottom line, though, is that such final outcome needs to be accounted for now. We would appreciate it if the County could initiate a working-conversation with the CSD, whether through the County's option for the Tri-W site or through the County's enforcement powers or otherwise, to address this issue, with the goal being to indicate the manner in which the outcome for the Tri-W site can be resolved now. From your email correspondence earlier today, it sounds like you have developed some options along these lines.

3. **Implementation specificity and timing.** We will be reviewing the County conditions as well as other project components with an eye towards refining implementation specificity, including in relation to deadlines. We appreciate your offer regarding identifying your timeline for water conservation elements in this respect, but would ask that you broaden that scope in relation to other aspects of the project as well, including implementation of the agricultural reuse and conservation plan. To us, this issue was clearly one of a need to hone in on what the County was going to do, how and when, and making sure these commitments made sense in relation to timing feasibility and potential adaptive management over time. That applies to the water conservation components but also to other project components, like agricultural reuse, as well. Any information you can provide on expected project timing and implementation specificity would be helpful in this regard, whether you want to develop a new product that summarizes this information or want to point us to existing information (e.g., EIR, County findings, etc.) or both.

4. **Willow Creek.** The contention is that the project results in an unaddressed and unmitigated 400 afy reduction in flow to Willow Creek to the detriment of creek. We understand that the Bayridge leach field would be used to put back 33 afy as part of the project, and that the County apparently found that this 33 afy would be an equal offset to existing septic flows, but we would like a clearer explanation as to why the County found this to be the case, and how project flows will affect Willow Creek resources. Please provide an analysis with supporting documentation (again, new product and/or direction to information).

5. **Hydrogeologic impacts.** Similar to the Willow Creek issue (see above) but on a broader scale, the Commission was concerned that there was a lack of impact identification and mitigation associated with the manner in which the project is going to alter groundwater flows, including with respect to adaptive management, over time. Although we all realize that at a broad scale the project concept is to enhance marine and groundwater resources (and associated resources, like wetlands, streams, riparian areas, etc.), the concern is that there is not enough specificity with respect to the manner in which this is to occur, when it is to occur, how it is to occur, and what contingencies are in place should certain features not work as well as planned and/or should certain components lead to adverse impacts (e.g. monitoring of Broderson disposal). It could be that the County intends the Groundwater Plan (condition 87) and related measures (i.e., condition 97) to be the vehicle for addressing this issue, but it appears clear that the Commission is looking for greater specificity than that vehicle, including in terms of identifying specific impacts and specific response now as part of the approval of the project to the degree possible. Please package together an analysis of this issue that includes a clear identification of existing and proposed flows, impacts and mitigations associated with changed flows, and a ‘balance sheet’ documenting benefits as well as adverse impacts and responses. Please send a copy of the materials to Mark Johnsson in our San Francisco office (45 Fremont Street, Suite 2000, San Francisco, CA 94105-2219) and a copy to us in Santa Cruz. Ultimately, we should work on identifying a specific, enforceable plan that ensures resources are protected

as much as possible as the project modifies flows over time, and ideally the bulk of such plan could be packaged together now.

6. **Staging area on ESHA.** The contention is that the County intends to use a staging area that is in ESHA, and that the County has already begun to clear and ready the site for the project without benefit of a CDP. Please package a set of materials specific to construction methodologies in relation to staging and materials storage areas. For all such areas, please provide details on their current state and any development associated with the project that has already occurred there.

7. **Septic tank plan.** The Commission raised concerns that there was inadequate specificity with respect to the ultimate disposition of the approximately 5,000 septic tanks currently in operation in the project area. Clearly, the County commits to assisting private landowners to reuse such tanks to optimize groundwater recharge (condition 88), but it appears possible that this may not happen as part of the project at all. Please identify a plan that identifies specifically what will happen to existing septic tanks in this respect, how and when. If there are multiple possible outcomes based on site specific criteria, please identify all such criteria.

As indicated at the onset, this isn't necessarily an exhaustive list, but it should get us started down the path toward the finish line. On that please note two things. First, it is unclear when this project will again be scheduled for a hearing. It will obviously take some time to package, review, analyze, conclude, and develop a recommendation for these and related issues. We will do our best with our limited staff to move quickly, but it is clear that much of the timely success of this next stage will be dependent on timely materials assistance from the County, as indicated above. Even optimistically, it seems likely that we are looking at a hearing at least several months away, and potentially longer. Second, we are prepared to discuss ways we could help to communicate with potential funding entities in such a way as to help the County with preserving and pursuing funding opportunities (e.g., staff recommendation letter; closing the federal consistency loop on funding; etc.).

I hope that this helps to detail next steps. Please contact me if you'd like to spend some time fleshing this out or if you have questions otherwise. As you indicate, we could do a conference call with appropriate persons too if that makes sense. Thanks…

Dan

February 16, 2010

Dan Carl
California Coastal Commission
725 Front Street Suite 300
Santa Cruz, CA 95060

Subject: CDP Materials for the Los Osos Wastewater Project

Dear Mr. Carl,

Enclosed with this letter are two sets of materials responding to the following items from your January 26, 2010 email requesting additional information on the Los Osos Wastewater Project. Please note that we are continuing to work on providing information to items 5 (Willow Creek), 6 (Hydrogeologic Impacts, and 7 (septic tank plan).

1. January 26, 2010 email from Dan Cark to Mark Hutchinson identifying County assistance tasks

2. Copy of January 27, 2010 Wetlands Information transmittal letter, previously sent under separate cover

3. ESHA Mitigation response with attachments:

   - Los Osos ESHA Mitigation Requirements Table
   - Los Osos Wastewater Project, San Luis Obispo County, ESHA Impacts and Mitigation Map
   - Wastewater Facilities Project, Los Osos CSD, ESHA Impacts and Mitigation Map
   - Current Tri-W Site photos

4. Implementation Timing/ Water Conservation Program response with attachments:

    - Implementation and Timing of Conditions of Approval Table
    - SRF Program Water Conservation Requirements
    - Groundwater Basin Map
    - Effluent Re-Use and Disposal Tech Memo, July 2008 (part)
    - Coastal Zone Land Use Ordinance Section 23.04.184 (Water Efficient Landscape Ordinance)
    - Los Osos Groundwater Basin Retrofit Ordinances:
        - Title 19
        - Title 8

5. Staging Areas on ESHA response with attachments:

    - Walker Aerial photos from 2003
    - Walker Aerial photos from 2007
    - Site photos from 2010

If you have any questions or need more information regarding these topics please feel free to contact me.

Sincerely,

MARK HUTCHINSON
Environmental Programs Manager

C: Paavo Ogren, Director of Public Works
John Waddell, Project Manager

C. In 1995, a study issued in by the RWQCB titled "Assessment of Nitrate Contamination in Ground Water Basins of the Central Coast Region Preliminary Working Draft," illustrated significant increases in nitrate concentrations over time in both the lower and upper aquifers. According to a letter from the RWQCB on July 10, 1998, 107 monitoring wells with more than 1,100 data points were used in the construction of the contour maps included in the study. The RWQCB letter stated:

Monitoring data indicates much of the shallow groundwater in the most densely developed areas exceeds 45mg/l, the drinking water standard for nitrate. For this reason, many of the shallow water supply wells have been removed from service and demand shifted to the deeper aquifer. Dependence upon the deeper aquifer exacerbates the surface water problems because the community's water supply, formerly from the upper aquifer, is now drawn from the deeper aquifer and recharged (after use) to the upper aquifer causing ground water levels to rise and flood more septic systems. Increasing surface water impacts including: restriction of portions of shellfish harvesting areas because of rising bacteria levels: water surround the Los Osos area periodically do not meet bacteria standards for water contact recreation (such as swimming, wading, kayaking and small boat sailing): and the public is increasingly exposed to surface wastewater.

These issues can be addressed with water use-efficiency septic system, and storm-water mngmt. plans

This is not supported by water quality data since 2003 (see Attachment 23)

This study and letter prompted further action to address the issue of groundwater contamination.

1.2.4 - Los Osos Community Services District

In 1998, the community voted to establish a community services district with wastewater authority. The Los Osos Community Services District (LOCSD) developed a wastewater collection and treatment project with the treatment facilities located in the west-central portion of the community (referred to as the Tri-W site but referred to as the Mid-town site in this document). The LOCSD prepared an EIR for the project and certified the EIR on March 1, 2001. After receipt of a Coastal Development Permit (CDP) project construction started in 2005. In the fall of 2005, voters recalled a majority of the LOCSD board members in a special election and the new board immediately halted construction on the wastewater project. In August 2006, the LOCSD rescinded certification of the 2001 EIR Findings and filed for federal bankruptcy protection due to default on State grants and loans.

1.2.5 - Legislative Initiatives

After the recall and suspension of construction, California Assemblyman Sam Blakely attempted to resolve the dispute between the RWQCB and LOCSD. The efforts were to no avail. Assemblyman Blakely then proposed legislation. Assembly Bill (AB) 2701 was proposed to authorize transfer of wastewater authority from the LOCSD to the County of San Luis Obispo to proceed with implementation of a project to build a wastewater collection and treatment system for the Los Osos

final proposed project's potential environmental impacts and public comments before completing and certifying the Final EIR.

The septic system prohibition drives the project; environmental goals + objectives are secondary.

3.1.2 - Project Goals and Objectives

The primary goal of the LOWWP is to construct and operate a community wastewater collection, treatment and disposal system and, thereby, comply with the RWQCB's WDR Resolution 83-13. Eliminating discharges from onsite wastewater, as directed by the RWQCB, will also help accomplish the LOWWP's second primary goal: alleviating groundwater contamination, primarily nitrates, that has occurred at least partially because of the use of septic systems throughout the community.

One of the wastewater project's secondary objectives involves water resources issues. Water resources issues are important because of seawater intrusion that is contaminating the Los Osos groundwater basin. On March 27, 2007, the County Board of Supervisors certified a "evel of Severity (LOS) III for the community of Los Osos while adopting a Resource Capacity Study of the Los Osos groundwater basin. The LOS III determination is the highest determination of a resource problem under the County's Resource Management System. The wastewater project can be an important first step to solving water resource problems. While the primary purpose of the Los Osos Wastewater Project is to construct a community wastewater system and, thereby, to alleviate groundwater contamination, how that goal is met can create or hinder opportunities for the water purveyors to improve the local water resources.

Environmental objective is vague

83-13 limits alternatives for achieving these that have fewer impacts

To summarize, the specific objectives of the Los Osos Wastewater Project are:

- **RWQCB Waste Discharge Requirements.** Address the issues of water quality defined by the Waste Discharge Requirements (WDR) for discharge limits issued by the RWQCB.
- **Groundwater Quality.** Alleviate groundwater contamination—primarily nitrates—that has occurred at least partially because of the use of septic systems throughout the community.
- **Secondary Objectives**
  - a) **Water Resources.** Address water resource issues by mitigating the project's impacts on water supply and saltwater intrusion. Further, the wastewater project will maintain the widest possible options for beneficial reuse of treated effluent.
  - b) **Environmental Impacts.** Incorporate measures to minimize potential environmental impacts on the Los Osos community and surrounding areas, (including, but not limited to, habitat conservation, endangered species and habitat, air and water quality, greenhouse gas emissions, social and economic sustainability, wetlands and estuary preservation or enhancement, cultural resources protection, and agricultural land enhancements).
  - c) **Project Costs.** Meet the project water quality requirements while minimizing life-cycle costs and the related affordability impacts to residents.
  - d) **Regulatory Compliance.** Comply with applicable local, State, and federal permits, land uses, and other requirements including the Local Coastal Plan, Environmentall

Improvements to the estuary and ESHA are not listed.

These mitigation objectives are vague and the project doesn't achieve them.

DEVELOPMENT PLAN / COASTAL DEVELOPMENT PERMIT DRC2008-00103
FINDINGS - EXHIBIT A

Environmental Determination

A. An Environmental Impact Report was prepared and circulated for the proposed project. Impacts were identified and mitigation measures were proposed for: visual resources, agricultural resources, air quality, biological resources, cultural resources, geology & soils, public health and safety, noise, traffic/circulation, groundwater resources, drainage and surface water quality, environmental justice, and land use & planning. The Final EIR also considers several project alternatives. Significant and unavoidable impacts to agricultural resources were identified for the project alternative (Giacomazzi treatment plant site) that was selected by the Planning Commission at the July 24, 2009 hearing. The EIR process was completed in accordance with CEQA and a Final EIR has been certified by the Planning Commission.

Coastal Development Permit

B. The proposed project or use is consistent with the San Luis Obispo County General Plan and Local Coastal Program because:

1. Public Utility Facilities are allowed under Table O of Framework for Planning in all land use categories except Recreation and Open Space, and as limited by planning area standards in the Estero Area Plan. The wastewater treatment facility is an allowable use at the proposed location (Giacomazzi site) because there is no other feasible location within the urban reserve boundary and is the environmentally superior alternative as determined through the Planning Commission hearing process, testimony at public hearings, and all the information included in the record for the Los Osos wastewater project.

2. The proposed Los Osos Wastewater Treatment Facility components are in conformity with the County's adopted general plan or part thereof applicable to the proposed project.

3. The project will balance protection of resources (e.g. groundwater resources, sensitive resources, etc.) with the necessity of providing a community sewer for the prohibition zone of the community of Los Osos as defined by Resolution No. 83-13 issued by the Regional Water Quality Control Board.

4. Agriculture policies encourage the preservation of viable agriculture. The proposed project is found to minimize agricultural impacts and will provide an additional water supply to promote the continuance of agriculture within the Los Osos Valley. Re-use of tertiary treated effluent for agricultural production would protect agricultural resources in the Los Osos Valley. The re-use of tertiary treated effluent would be consistent with the surrounding area because the water is treated to Title 22 standards (California Code of Regulations) which allows the water to be placed on edible food crops, landscape areas, etc. and would not result in impacts to surrounding uses.

5. Public Works policies ensure that adequate facilities are available for new and anticipated development. The proposed project will not increase the demand for services and will only allow development consistent with applicable area plan standards as conditioned herein.

6. Coastal Watershed policies are meant to maintain productivity of coastal waters and to manage new development so that the resource is

DEVELOPMENT PLAN / COASTAL DEVELOPMENT PERMIT DRC2008-00103
EXHIBIT B - CONDITIONS OF APPROVAL

Approved Development

1. This approval authorizes construction and operation of a community-wide sewer system for the portion of Los Osos described in Resolution No. 83-13 issued by the Regional Water Quality Control Board (see Attachment 1) and as described by application materials, supplemental materials made a part of the record, and shown in the EIR, including:

   a. A wastewater treatment facility, including all appurtenant structures, landscaping and site access to be located on the Giacomazzi site (APN 067-011-022);
   b. A wastewater collection system, including lateral lines from individual structures to the street, connection lines at each property, sewer mains, back-up power facilities and pump stations;
   c. Construction staging areas;
   d. Wastewater disposal facilities, distribution lines for urban and agricultural re-use, and monitoring wells;
   e. Wastewater sludge handling facilities at the wastewater treatment plant to enable the hauling of sludge to a disposal, recycling facility or co-generation facility;
   f. Primary staging areas at East Paso Robles Street including minor and temporary staging areas in the project area including the Giacomazzi site;
   g. Construction activities associated with the installation of approved facilities, including dewatering operations;
   h. A program for the mitigation of direct impacts to habitat for endangered species and agricultural resources;
   i. Construction of an underground pump station located at 3rd Street and the intersection of Paso Robles Avenue (unimproved), within 75' of a coastal wetland;
   j. Construction of harvesting wells and their associated piping and facilities are NOT authorized by this approval; and
   k. A water conservation program allowing a maximum water usage of 50 gallons per day / person for indoor water usage.

2. Except as otherwise required by the conditions of this permit, all development shall be substantially consistent with the site plan attached as Attachment 2, as well as with all final architectural elevations, color boards and landscape plans to be reviewed and approved by the Planning Director.

3. All development shall be consistent with the conditions contained herein. Prior to final design / layout of the East Paso Robles Avenue pump station and the Doris Avenue / Lupine Street pump station, the applicant shall provide verification to the satisfaction of the Planning Director, that the required 75 foot wetland setback will be met with the redesign / layout of said pump stations.

4. The approved service area for the wastewater treatment facilities corresponds to the area shown on the Service Area Map attached (see Attachment 1)
   Future additions to the wastewater treatment service area shall require a separate coastal development permit, and must be preceded or submitted concurrently with an Local Coastal Plan (LCP) amendment that incorporates the proposed service area expansion within the Urban Service Line designated by the LCP.

5. No Guarantees of Development Approvals. Approval of this permit, or any method of financing the project utilized by the County (e.g., the established assessment program), does not guarantee County approval of any new or intensified uses within the service area. All new development proposals must be reviewed for consistency with the San

drilling (HDD) within all areas along the proposed conveyance routes, and pipe suspension at areas supporting existing bridge crossings along the proposed conveyance routes (at the Los Osos Creek crossing).

Microtunneling and HDD entrance and exit locations shall be set back as far away from wetlands, streams, and riparian vegetation as feasible and consistent with the setback requirements of the CZLUO and Estero Area Plan. Implementation of microtunneling and HDD methodologies shall incorporate a frac-out contingency plan and all relevant Best Management Practices during construction.

Maintenance activities associated with pipe suspension that may result in activity within the streambed of Los Osos Creek shall be restricted to periods when the streambed is dry and does not support any flowing water or pooling water in the proposed maintenance area.

Post Construction

84. Prior to operation of the wastewater treatment system, the applicant shall:

    a) Obtain final inspection approval of all required fire/life safety measures.

    b) Prior to operation of the wastewater treatment system, all Public Works Encroachment permit provisions shall be completed to the satisfaction of the Department.

85. Rehabilitation of disposal percolation fields shall be rotated so that no more than one field is under re-construction at a time.

86. Consistent with condition of approval # 34 is for Coastal Development Permit (CDP A-3-SLO-03-113 / D020283).To prevent the wastewater treatment system from inducing growth that cannot be safely sustained by available water supplies, the sewer authority is prohibited from providing service to existing undeveloped parcels within the service area, unless and until the Estero Area Plan is amended to incorporate a sustainable buildout target that indicates that there is water available to support such development without impacts to wetlands and habitats.

87. Concurrent with the operation of the facility, the County shall implement the Groundwater Level Monitoring and Management Plan that details methods for measuring and responding to changes in groundwater levels that could affect wetland hydrology and habitat values. The Plan includes provisions for monitoring groundwater levels, surveys for wetland plant and animals, monitoring wetland hydrology and water quality, appropriate response procedures should impacts be identified, annual reporting, and an education program to encourage property owners to convert septic systems into areas capable of groundwater recharge.

88. In order to maintain existing levels of groundwater recharge and protect coastal water quality, the County shall evaluate and, where appropriate, assist property owners in the implementation of opportunities to re-use existing septic tank effluent disposal systems (e.g., leach fields) to filter and percolate stormwater runoff. Prior to the connection of individual properties the County shall, at the consent of the landowner, evaluate whether existing on site wastewater disposal facilities have adequate capacity and depth to groundwater to accommodate and percolate stormwater runoff, and if so, provide site-specific recommendations on how to connect such a system.

89. The Los Osos wastewater project (including collection, treatment and disposal) shall be operated in a manner that prevents the emission of nuisance odors that are perceptible at or beyond the property lines of the project site, consistent with the requirements of Health and Safety Code Section 41700. Nuisance odors, problems with the operation of the wastewater treatment plant or dust complaints shall be directed to the operators of the wastewater treatment plant. The San Luis Obispo County Air Pollution Control District (SLOAPCD) will also respond to complaints and communicate immediately with the operators of the wastewater treatment plant. All complaints, breakdowns, or parameter exceedence shall be reported to the SLOAPCD within four (4) hours of receipt or event.

90. **Condition eliminated**

91. Screen Planting - Trees and shrubs shall be planted along the perimeter of the wastewater treatment facility prior to facility operation or at the earliest time feasible after completion grading activities. To provide effective screening, the size and variety of evergreen trees shall be planted which will reach a minimum height of 25 feet within five years. Large shrubs shall be included to provide lower height screening. Italian Cypress and other distinctly-shaped non-native plants shall not be used. The screen planting shall be designed to appear as a naturally appearing swath of vegetation. Evidence shall be submitted to the Department of Planning and Building to show that 75% screening has been achieved within 5 years. Landscape must be maintained to provide the required or better screening in perpetuity.

92. Prior to providing wastewater treatment service to undeveloped parcels, the County, in coordination with the California Department of Fish and Game (CDFG), the US Fish and Wildlife Service (USF&WS), San Luis Obispo County and the California Coastal Commission shall prepare and implement a Habitat Conservation Plan (HCP) for the long-term preservation of habitat remaining within the Los Osos Greenbelt, including habitat remaining on individual vacant lots. The HCP shall:

    a. identify the habitat resources and the quality of those resources on the remaining vacant properties within the South Bay Urban Area and Los Osos Greenbelt;

    b. specify measures to avoid and minimize impacts to ESHA from buildout of the Service area, and to mitigate unavoidable impacts through acquisition, protection, and/or restoration of equivalent habitat within the planning area; and

    c. implement such measures through an amendment to the Estero Area Plan that integrates the HCP, as approved by the US Fish and Wildlife Service and Department and Fish and Game, with LCP standards for development in the South Bay Urban Area. This LCP amendment must become fully effective, and all permits required by state and federal Endangered Species Acts shall be issued, before County makes any final commitment to provide wastewater treatment service to undeveloped properties.

    The range of potential conservation programs to be considered in the HCP shall include, but not be limited to the following:

        a. New development programs and standards that maximize preservation of sensitive biological resources in the Los Osos area, such as:

            i. Transfer of development credits
            ii. Clustering

iii. Avoidance of sensitive resources in site design
iv. Changes in density and land use
v. Incorporation of open space into the design of new development

b. Programs aimed at facilitating coordination among agencies and organizations involved in management and conservation/preservation of sensitive resources, including USF&WS, CDFG, California Coastal Commission, San Luis Obispo County, MBNEP, Land Conservancy of San Luis Obispo County, and others;

c. The creation of a land bank program to facilitate the purchase of properties with high quality habitat within the Greenbelt, to be repaid over time from fees on new building permits; and

d. Programs for the acquisition of properties within the Greenbelt that contain significant habitat resources.

The County may apply for amendment to this permit condition at, or prior to the time that the treatment plant is operational, to authorize the County to issue Will Serve letters to properties that would otherwise qualify.

93. **Condition eliminated**

94. Installation of lateral lines will conform to the mitigation procedures contained in the "Lateral Line Installation — Biological Resources & Mitigation" report dated 10-16-02.

95. [Mitigation 5.11-A1] Prior to operation of the wastewater treatment system, the County Department of Public Works shall provide evidence to the County Planning and Building Department that a farmland conservation easement, a farmland deed restriction, or other farmland conservation mechanism burdening an off-site agricultural mitigation parcel has been granted in perpetuity to the County or a qualifying entity approved by the County Agricultural Commissioner (or designee). The easement shall provide conservation acreage at a ratio of not less than 2:1 for the loss of agricultural land. Additionally, the project proponent shall provide appropriate funds (as determined by the County Planning Department) to compensate for reasonable administrative costs incurred by the easement holder. The area conserved shall be at least 32 acres (to offset direct impacts from the treatment plant facility), and shall be of a quality that is reasonably (as determined by the County Agricultural Commissioner or designee) similar to that of the farmland within the project limits. The area to be conserved shall be located within San Luis Obispo County within reasonable proximity to the project site.

96. Site Management Plan. Prior to operation of the facility, the County, in consultation with resource agencies, will develop a Site Management Plan for the remainder of the new public lot to be created out of the Giacomazzi property. The Site Management Plan will provide for the continued operation of agricultural activities on those portions of the property not used for the project and/or associated mitigation consistent with the affirmative agricultural easement requirements described herein. Implementation of the Plan will ensure that uses or land stewardship practices do not impede adjacent agricultural uses and practices and may include, but not be limited to:

(a) Maintenance of fences sufficient to clearly delineate property lines, contain livestock, prevent trespass, and manage non-native invasive species.

(b) Prevention and management actions to avoid the proliferation of weeds and noxious plants that are incompatible with adjacent agricultural practices.

(c) Management of all on-site water features, including springs, streams, and ponds in a manner that does not result in erosion or sedimentation impacts on downstream properties.

The Site management will be reviewed and approved by the Director of Planning and Building in consultation with the Agricultural Commissioner prior to implementation.

97. Nothing in this condition shall preclude disposal of treated effluent in accordance with a court judgment arising from the current groundwater litigation involving the Los Osos Groundwater Basin.

Disposal of treated effluent shall be reserved for the following sites/uses:

a. Broderson (not to exceed 448 AFY on an average annual basis),
b. Urban re-use within the urban reserve line (as identified in the Effluent Re-Use and Disposal Tech Memo, July 2008),
c. Agricultural re-use overlying the Los Osos Groundwater Basin,
d. Environmental reservations (not less than 10% of the total volume of treated effluent), and
e. Other agricultural re-use within Los Osos Valley.

Total agricultural re-use shall not be less than 10% of the total treated effluent. Disposal shall be prioritized to reduce seawater intrusion and return/retain water to/in the Los Osos groundwater basin. Highest priority shall be given to replacing potable water uses with tertiary treated effluent consistent with Water Code Section 13550.

No amount of treated effluent may be used to satisfy or offset water needs that result from non-agricultural development outside the Urban Reserve Line of the community of Los Osos.

98. Where the collection system pipes will be located in areas of high groundwater, or areas subject to future 5 foot sea level rise, as shown on the June 29 and 30, 2009 PC Memo – page: 1-16 (see Attachment 3), and as identified in the field during construction; the applicant shall utilize fusion welded pipes or chemically sealed pipes. In areas of high groundwater, additional inspections to ensure proper installation shall be completed prior to backfilling the trenches. All laterals to individual residences shall utilize fusion welded pipes or chemically sealed pipes. Lateral connections at the property line shall utilize fusion welded pipes, chemically sealed pipes, or collars.

99. Within one year of adoption of a due diligence resolution by the Board of Supervisors, electing to proceed with a wastewater project, a water conservation program shall be developed by the applicant in consultation with the local water purveyors within the prohibition zone for the community of Los Osos, that meets the goal of 50 gallons per day / per person for indoor use. The applicant shall provide 5 (five) million dollars of funding towards a water conservation program for indoor water conservation. Incentives shall be provided to homeowners and other property owners who install conservation measures within the first year.

100. Prior to operation of the wastewater treatment system, the applicant shall provide a new on-site well for facility operations in accordance with California Well Standards and County Ordinances and to the satisfaction of the Environmental Health Department.

101. The applicant shall utilize the existing Bayridge leach field (APN 074-491-033) to dispose of approximately 33 acre feet per year of treated effluent upon decommissioning of the existing leach field and connection to the community sewer system. The applicant shall consult with the Los Osos Community Services District (LOCSD) prior to the design phase of the project regarding use of said facilities to ensure all their concerns are addressed.

102. The applicant shall design the layout of the proposed sewer treatment facility to allow for structures to have roofs with “due south orientation” to maximize solar orientation for future solar photovoltaic and / or solar water panel installation, as feasible. No evergreen trees (with mature heights over 12 feet) shall be planted near structure that could potentially block the sun to these portions of the roofs unless necessary for visual screening. This shall be reflected in any landscape plans prepared / required. As a part of roof design / construction, these portions of the roofs shall be designed to be able to handle the “dead” loads associated with the weight of these panels. To further maximize solar efficiency, where possible, roof pitch of this portion of roof shall be as close to 20 degrees as practical. The applicant shall provide verification to the satisfaction of the County Planning and Building Department that the above measures have been incorporated into the project.

103. Prior to individual property connections to the waste water system, each property owner shall provide verification to the satisfaction of the Planning Director that all toilets, showerheads and faucets have been replaced with high efficiency versions of the same.

104. Agriculture irrigation lines and other wastewater effluent disposal lines shall be located within existing right-of-ways (including agricultural field access ways) and other areas known to not include, or that can be demonstrated to not include, cultural or biological resources. Use of the effluent shall be consistent with all other local, State, and Federal regulatory requirements including but not limited to the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands requirement of the Central Coast Regional Water Quality Control Board.

105. Bio-solids shall be disposed of at the closest approved facility within the San Luis Obispo County region. The San Luis Obispo County region shall be limited to the northern San Luis Obispo county line and south to the Santa Maria area within Santa Barbara County. If an approved facility is not available within the San Luis Obispo County region at the time of project start-up, then the closest approved facility shall be utilized. If an approved facility becomes available for disposal of bio-solids within the San Luis Obispo County region, that facility shall be utilized for disposal of bio-solids.

106. If the County acquires more land area than is necessary to site the treatment facility and appurtenant facilities, then prior to transferring title of the surplus area, the County shall record an affirmative agricultural easement over such surplus land. This easement shall take into consideration biological, cultural, sedimentation and erosion constraints on the project site. Agricultural activities chosen to take place on the remainder of the wastewater treatment facility site shall be consistent with the long term protection of the identified resources.

107. The applicant shall apply for and record a public lot prior to commencement of construction activities at the wastewater treatment site.

108. Prior to individual property connections to the wastewater treatment project, each property owner shall provide verification to the satisfaction of the Public Works Department (in consultation with the Planning Director) that a water meter meeting American Water Works Association (AWWA) standards, and approved by the water company serving the individual property, has been installed or is existing on the connection site. A water meter shall be installed on each legally established residential / commercial unit prior to connection to the wastewater treatment project. Water usage information shall be made available to the sewer authority on a quarterly basis or on a schedule agreed to by the water purveyors and the County to verify the water savings derived from the water conservation program.

109. Prior to commencing construction activities at the Giacomazzi site, the applicant shall submit to the Department of Public Works for review and approval a Roadway Safety Analysis (RSA) for the intersection of the treatment plant access road with Los Osos Valley Road. The RSA shall be prepared by a registered civil engineer with expertise in transportation design and familiarity with the Los Osos Valley Road corridor, and shall include but not be limited to the following:

a) Evaluate the proximity of the cemetery access road with the project access road and discuss corrective options including realignment, road mergers (sharing) and alternative project access road locations;

b) Analyze the project access road sight distance with respect to Los Osos Valley Road and recommend improvements, if required;

c) Analyze Los Osos Valley Road left turn lane warrants and traffic queuing at the project access road and recommend improvements, if required;

d) Evaluate Los Osos Valley Road traffic safety a minimum of 1-mile either side of the treatment plant access road and provide recommendations for improvements, if required;

e) Evaluate erosion control measures such as gravel pads, rumble strips and wheel washers to avoid the tracking of dirt and sediment onto adjacent private and public roadways during construction, and recommend best management practices to be implement; and

f) Evaluate onsite circulation with specific emphasis on truck maneuvering, access for emergency vehicles, onsite parking, and all-weather roadbed materials, provide recommendations and an implementation plan.

All RSA recommendations shall be implemented prior to commencing construction activities.

110. The aboveground facilities for the mid-town pump station shall be re-located to Palisades Avenue (south of the Library) on APN 074-229-017.

111. Routine flushing of sewer system lines shall utilize recycled water. In the event of an emergency situation, potable water may be used to flush the sewer system if non-potable water is determined to be infeasible.

Willow Creek Impacts

Planning Commission Meeting 6/30/09 (1:50:00 to 2:03:00)
Spencer Harris (Cleath-Harris, Geologists, Inc.—LOWWP consultant, author of primary hydrogeology report in DEIR, Appendix C of D-2)

1:54:56 (Spencer Harris) …the discharges…the subsurface outflow to the Willow Creek is anticipated to decline significantly by a few hundred acre feet. That's not seasonal run off—that's what's rising into that …surfacing from the septics…so

1:55:24 If you look at historically what has developed, what naturally grew there like the oaks and whatever was present before large scale development took place in town… There's not going to be less water going into the upper aquifer than before development; there will be a certain amount of drying up—yes—and you'd be reverting back to what would be predevelopment type conditions.

California Coastal Commission

COASTAL DEVELOPMENT PERMIT

CDP A-3-SLO-09-055/069 (Los Osos Wastewater Project)

Issue Date: September 7, 2010

Coastal development permit (CDP) number A-3-SLO-09-055/069 was approved by the California Coastal Commission on June 11, 2010. CDP A-3-SLO-09-055/069 provides for the construction and operation of a community sewer system, including a treatment plant, collection/disposal/reuse facilities, and all associated development and infrastructure (all as more specifically described in the Commission's CDP file). CDP A-3-SLO-09-055/069 is subject to certain terms and conditions, including the standard and special conditions beginning on page 2 of this CDP.

By my signature below, the CDP is issued on behalf of the California Coastal Commission:

9/7/2010

Dan Carl, Central Coastal District Manager for Peter M. Douglas, Executive Director

Acknowledgement

The undersigned Permittees acknowledge receipt of this coastal development permit and agree to abide by all terms and conditions thereof. The undersigned Permittees acknowledge that Government Code Section 818.4 (that states in pertinent part that "a public entity is not liable for injury caused by the issuance of any permit") applies to the issuance of this coastal development permit.

9/17/2010

Permittee: San Luis Obispo County Public Works Department Date

Please note that this coastal development permit is not valid unless and until a copy of it with the signed acknowledgement has been returned to the California Coastal Commission's Central Coast District Office (14 Cal. Admin. Code Section 13158(a)).

CDP A-3-SLO-09-055/069 (Los Osos Wastewater Project)

Standard Conditions

1. **Notice of Receipt and Acknowledgment.** The permit is not valid and development shall not commence until a copy of the permit, signed by the Permittee or authorized agent, acknowledging receipt of the permit and acceptance of the terms and conditions, is returned to the Commission office.

2. **Expiration.** The permit will expire on June 11, 2012 if development has not commenced by that date. Development shall be pursued in a diligent manner and completed in a reasonable period of time. Application for extension of the permit must be made prior to the expiration date.

3. **Interpretation.** Any questions of intent or interpretation of any condition will be resolved by the Executive Director or the Commission.

4. **Assignment.** The permit may be assigned to any qualified person, provided assignee files with the Commission an affidavit accepting all terms and conditions of the permit.

5. **Terms and Conditions Run with the Land.** These terms and conditions shall be perpetual, and it is the intention of the Commission and the Permittee to bind all future owners and possessors of the subject property to the terms and conditions.

Special Conditions

1. **Final Project Plans.** PRIOR TO CONSTRUCTION, the Permittee shall submit two copies of Final Project Plans to the Executive Director for review and approval. The Final Project Plans shall include and shall be substantially in conformance with the plans associated with the proposed project description (see Section B.3. of this report) except that they shall be revised and supplemented to comply with the following requirements:

   a. **Treatment Plant Site Approved Development Envelope.** All development (including but not limited to buildings, tanks, infrastructure, parking, walkways, fences, etc.) shall be located within the development envelope and in the general configuration shown on Exhibit 2 (*Exhibit 1-3, Treatment Plant Site Plan*; last dated revised on April 13, 2010, and dated received in the Commission's Central Coast District Office on April 19, 2010). Development shall be prohibited outside of the approved development envelope except for habitat restoration and enhancement related development (see special condition 3(b) below) and access road related development (see special condition 1(b) below). Development shall be arranged so that activity and direct light that may be visible from outside of the development envelope is limited to the maximum extent feasible, and so that any activity that is unavoidably visible is minimized in its intensity. All development shall be identified on the Final Project Plans.

   b. **Treatment Plant Site Access Road.** The access road shall be located along the existing unpaved access road alignment extending from Los Osos Valley Road to the approved development envelope along the eastern property line of the Los Osos Mortuary and Memorial Park site and the western property line of the Andre site in such a manner as to limit its width and overall length as much as possible. The access road shall include measures to effectively screen noise

and activity associated with access road traffic and activity from adjacent properties so long as such screen does not itself degrade public views from along Los Osos Valley Road. If the Permittee conclusively demonstrates that the above access road location is infeasible, then the access road shall be located as shown on Exhibit 2 (*Exhibit 1-2 Overall Project Site Plan*, New Access Road, last dated revised on April 13, 2010, and dated received in the Commission's Central Coast District Office on April 19, 2010) subject to all the same siting and design criteria, and subject to the additional requirement that a mitigation plan for impacts to the agricultural use and development of the property located between the access road, Los Osos Valley Road, and the Los Osos Mortuary and Memorial Park site shall be submitted for Executive Director review and approval.

c. **Treatment Plant Site Design.** The design and appearance of all development shall reflect a rural agricultural theme (i.e., simple and utilitarian lines and materials, including use of board and bats, corrugated metal, muted earth tone colors, etc.). The plans shall clearly identify all measures that will be applied to ensure such design aesthetic is achieved, including with respect to all structures and all other project elements within view of Los Osos Valley Road (including the access road itself, all drainage facilities, curbs, landscaping, screens, signs, etc.). Development shall be sited and designed so as to reduce its visibility from Los Osos Valley Road to the maximum extent feasible. At a minimum, the plans shall clearly identify all structural elements, materials, and finishes (including through site plans and elevations, materials palettes and representative photos, product brochures, etc.).

d. **Pump Station and Related Development.**

1. **Pump Station Design**. All pump stations and all related development, including all power boxes and buildings, shall be sited and designed to limit impacts on habitat areas and public views, including through limiting their footprint and proximity to habitat areas as much as possible, siting elements below ground where feasible, minimizing the scale of above ground elements as much as possible, limiting above-ground access components (including manhole/hatch entries) as much as possible, using surface treatment and structural design consistent with and compatible with the immediately surrounding environment, limiting lighting to that necessary for public safety, and removing non-native invasive plant species on each site and landscaping with appropriate native plant materials (see also special condition 3(d)) including so that landscaping can help soften the appearance of any elements that are unavoidably above ground and to ensure seamless connectivity to surrounding habitat and vegetation as much as possible.

2. **Midtown Pump Station.** The Midtown pump station shall be sited and designed to limit its footprint and depth (from the road). The Midtown pump station power building shall be relocated across Palisades Avenue to an already disturbed area of Los Osos Community Park in a location where it will have the least impact on Park use and aesthetics.

3. **Lupine Street Pump Station.** The Lupine Street pump station and standby power building shall be set back a minimum of 75 feet from the edge of wetlands located to the south and west of the pump station site.

e. **Lupine Street Force Main.** The force main that conveys sewage from the Lupine Street Pump Station towards the treatment plant shall be routed from the Lupine Street Pump Station east on Lupine Street, then south on Fearn Avenue, then east on Binscarth Road, and then south on Pine Avenue, terminating at Los Osos Valley Road.

f. **Recycled Water Re-use Infrastructure.** All recycled water reuse pipelines and related development shall be clearly identified, including all such development noted on the overall project site plan submitted to the Commission (titled *Exhibit 1-2, Overall Project Site Plan*, last dated revised April 13, 2010; dated received in the Commission's Central Coast District Office April 19, 2010) and also including connecting segments to each of the receiver sites identified there.

g. **Lighting.** All interior lighting shall be located so as to minimize the potential for light and glare to be visible from within adjacent habitat areas, including adjacent restoration and enhancement areas. All exterior lighting shall be shielded and be of the lowest intensity feasible in order to avoid artificial light pollution from project facilities into adjacent areas and the night sky. All exterior lighting elements adjacent to habitat areas, including adjacent to restoration and enhancement areas, shall be avoided where possible and where unavoidable for safety purposes shall be the minimum necessary to meet safety requirements, shall be shielded, and shall be directed downward and away from such habitat areas.

h. **Landscaping.** Final Plans shall include landscape and irrigation parameters that shall identify all plant materials (size, species, quantity), all irrigation systems, and all proposed maintenance for landscaping at both the treatment plant site (including along the access road) and at all pump station locations. All plant materials shall be native and non-invasive species selected to be complimentary with the mix of native habitats in the project vicinity, prevent the spread of exotic invasive plant species, and avoid contamination of the local native plant community gene pool. The landscape and irrigation plans shall be designed to protect and enhance native plant communities on and adjacent to the development locations, including required restoration and enhancement areas, and to provide a transitional buffer between native habitat areas and authorized development. Landscaping (at maturity) shall also be capable of partial/mottled screening and softening the appearance of new development as seen from public viewing areas as much as possible. All landscaped areas shall be continuously maintained by the Permittee in a litter-free, weed-free, and healthy growing condition. No plant species listed as problematic and/or invasive by the California Native Plant Society, the California Invasive Plant Council, or as may be so identified from time to time by the State of California, and no plant species listed as a 'noxious weed' by the State of California or the U.S. Federal Government shall be planted or allowed to naturalize or persist at the treatment plant site (including along the access road) and at all pump station locations.

i. **Sign Plan.** All signs associated with the approved project and identifying any component of it as seen from public viewing areas shall be identified and details showing the location, materials, design, and text of all signs shall be provided. The signs shall be sited and designed so as to provide clear information without adversely impacting public views and/or the character of the area in which the sign is located. At least three public education/interpretation signs and/or

displays related to the project shall be installed at appropriate locations (e.g., at the Broderson site, at the Midtown site, and at the Giacomazzi site) easily accessible by the public, including in relation to the treatment plant site and at individual pump stations with significant above ground features.

j. **Street Reconstruction.** The Plans shall require that all public roadway work, including and up to complete roadway reconstruction, following installation/construction of approved project elements that impact public roadways shall be conducted in a manner that incorporates low impact development (LID) techniques and water quality protection systems to the maximum amount feasible.

k. **Walker Site.** The 6-acre Walker site (see Exhibit 2), although restoration of this area is not required until after it is no longer being used as the primary construction staging site for the approved project, shall be to be returned to its pre-project condition, or better (from a habitat perspective).

l. **Construction.** All construction staging and related areas shall be identified, and all development associated with such areas shown on a site plan. All such areas within which construction staging are to take place shall be minimized to the maximum extent feasible in order to minimize impacts on resources (e.g., terrestrial habitat, wetlands, creeks, riparian areas, or other sensitive resource areas, etc.). All measures to be taken to minimize impacts associated with construction staging and related areas shall be identified, including but not limited to screening, fencing, landscaping, signage, and designation of various activity and storage areas on the site. If additional construction staging and related areas are needed following approval of Final Plans, such areas shall be identified in a plan and submitted for Executive Director review and approval. The Final Plans shall require that copies of the signed CDP be maintained in a conspicuous location at the construction staging area at all times, and that such copies be available for public review on request. All persons involved with the construction shall be briefed on the content and meaning of the CDP, and the public review requirements applicable to them, prior to commencement of construction. The Final Plans shall also require that a primary construction coordinator be designated for public inquiries regarding the construction, and that their contact information (i.e., address, phone numbers, etc.) including, at a minimum, a telephone number available 24 hours a day for the duration of construction, be conspicuously posted at the construction staging area and at individual construction sites where such contact information is readily visible from public viewing areas, along with indication that the construction coordinator should be contacted in the case of questions regarding the construction (in case of both regular inquiries and emergencies). The construction coordinator shall record the name, phone number, and nature of all complaints received regarding the construction, and shall investigate complaints and take remedial action, if necessary, within 24 hours of receipt of the complaint or inquiry.

The Permittee shall undertake development in accordance with the approved Final Project Plans.

2. **Septic System Decommissioning Plan.** PRIOR TO ANY CONNECTION TO THE APPROVED WASTEWATER PROJECT, the Permittee shall submit two copies of a Septic System

Decommissioning Plan to the Executive Director for review and approval. The Septic System Decommissioning Plan shall clearly identify all measures to be taken to appropriately decommission existing septic tank systems and to connect such users to the approved project. The Plan shall provide a process for evaluating septic systems for possible on-site reuse, including for on-site filtration and percolation of stormwater to the degree feasible and appropriate, and a process for implementing such conversion or for implementing appropriate abandonment measures depending on which measure property owners choose. The Permittee shall undertake development in accordance with the approved Septic System Decommissioning Plan.

3. **Habitat Management Plan.** PRIOR TO CONSTRUCTION, the Permittee shall submit two copies of a Habitat Management Plan to the Executive Director for review and approval. The Habitat Management Plan shall provide for restoration and enhancement of the following areas to self-sustaining natural habitat states, and for management and protection of such areas as habitat areas in perpetuity:

   a. **Broderson Site.** The 80-acre Broderson site, of which up to 8 acres is allowed to be used for the project leach field provided this area too is subject to Plan requirements designed to ensure habitat value in this 8-acre area as much as possible while recognizing the underlying leach field infrastructure and its ongoing use and maintenance requirements.

   b. **Giacomazzi Site.** The 8.3 acres of the Giacomazzi site that is located outside of the approved development envelope and that includes identified wetland and related resources and their buffer (see Exhibit 8).

   c. **Midtown Site.** The 12.24-acre Midtown site (see Exhibit 2), of which a small area (approximately 0.10 acres, subject to special condition 1 requirements) is allowed to be used for the Midtown pump station and related development, provided this area, too, is subject to Plan requirements designed to ensure habitat value at the pump station location as much as possible while recognizing the underlying pump station infrastructure and its ongoing use and maintenance requirements.

   d. **Pump Station Sites.** The roughly 0.1-acre Sunny Oaks site, the 0.4-acre Solano site, and the 0.3-acre East Ysabel site (see Exhibit 2), a total of almost one acre, of which a small area at each site (approximately 0.32 total acres, subject to special condition 1 requirements) is allowed to be used for pump station and related development, provided these areas, too, are subject to Plan requirements designed to ensure habitat value at the pump station locations as much as possible while recognizing the underlying pump station infrastructure and its ongoing use and maintenance requirements.

The Habitat Management Plan shall require and provide for the Broderson site to be acquired prior to construction and granted by June 10, 2012 to an appropriate agency or conservation organization approved by the Executive Director, where such grant shall include funding adequate to implement the Habitat Management Plan over time. The Habitat Management Plan shall require and provide for the use of the Broderson, Giacommazi, Midtown, and Pump Station sites each to be restricted through recordation of a deed restriction, prohibiting all non resource-dependent development on each site, other than that associated with the approved project and consistent with the approved

Habitat Management Plan. The required deed restriction shall be in a form and content acceptable to the Executive Director and recorded free of prior liens and any other encumbrances that the Executive Director determines may affect the enforcement of the deed restriction.

The Habitat Management Plan shall be prepared by qualified restoration ecologists, shall be submitted with evidence of USFWS and CDFG review (or evidence that no review is required), and shall take into account the specific condition of each restoration and enhancement site (including soil, exposure, water flows, temperature, moisture, wind, etc.), as well as restoration and enhancement goals and success criteria. The Habitat Management Plan shall explicitly allow for potential public access interpretive facilities (including trails, signs/displays, etc.) even if such facilities are not part of initial Habitat Management Plan implementation activities, but rather will be a part of subsequent Plan implementation. At a minimum, the Plan shall provide for the following:

a. **Baseline.** A baseline assessment, including photographs, of the current physical and ecological condition of the restoration and enhancement areas. All existing topography, habitat types, and vegetation shall be depicted on a map.

b. **Goals.** A description of the goals of the plan, including in terms of topography, hydrology, vegetation, sensitive species, wildlife usage, and potential public interpretive access.

c. **Planting and Invasive/Non-Native Plant Provisions.** Except that the mature eucalyptus trees, and the mature cypress trees on the Broderson site shall remain and be managed as part of the Plan, all invasive and/or non-native plant species shall be removed from all restoration and enhancement areas, and native species of local stock appropriate to the habitats and the Los Osos area shall be planted,. A planting plan including the planting palette (seed mix and container plants), planting design, source of plant material, plant installation, erosion control, irrigation, and remediation shall be included. The planting palette shall be made up exclusively of native taxa that are appropriate to the habitats and the Los Osos region. Seed and/or vegetative propagules shall be obtained from local natural habitats so as to protect the genetic makeup of natural populations. Horticultural varieties shall not be used. Non-native and/or invasive plant species shall be prohibited. No plant species listed as problematic and/or invasive by the California Native Plant Society, the California Invasive Plant Council, or as may be so identified from time to time by the State of California, and no plant species listed as a 'noxious weed' by the State of California or the U.S. Federal Government shall be planted or allowed to naturalize or persist in the restoration and enhancement areas.

d. **Hydrology.** Ensuring that existing hydrological inputs, if applicable (e.g. for wetland areas at the Giacomazzi site), are maintained and if possible improved in favor of enhanced habitat value. To the extent there may be hydrological issues related to the habitat that is being restored and monitored overtime, these issues shall be considered and dealt with appropriately.

e. **Success Criteria**. A description of the measurable success criteria of the plan, including, at a minimum, the requirement that success be determined after a period of at least three years in which the sites have been subject to no remediation or maintenance activities other than weeding, and that this condition be maintained in perpetuity. Success criteria shall be defined for each habitat type, including in terms of species diversity, percent cover, invasive control, wildlife

usage, and hydrology, and for potential public interpretive access. Interim and long-term success criteria shall be identified, with final success criteria required to be maintained in perpetuity.

f. **Monitoring.** Monitoring and maintenance provisions including a schedule of the proposed monitoring and maintenance activities to ensure that interim and long-term success criteria are achieved, and including a plan for documenting and reporting the physical and biological "as built" condition of the restoration and enhancement areas within 30 days of completion of the initial Habitat Management Plan implementation activities (i.e., a simple report to describe field implementation of the approved plan in narrative and photographs, and to report any implementation problems and their resolution). Monitoring shall be appropriate to habitat type, and shall at a minimum include identification of field sampling protocols (including specific field sampling techniques to be employed), study sites (including experimental/revegetation sites and reference sites), data analysis methods (including descriptive and inferential statistics with specified acceptable variance and significance levels to examine sample size, univariate and multivariate comparisons, and/or other parameters as appropriate and necessary to assess progress toward and meeting of success criteria), and assessment of progress toward meeting identified success criteria.

g. **Reporting.** Provision for submission of annual monitoring reports (two copies each time) to the Executive Director for review and approval beginning the first year after completion of initial Habitat Management Plan implementation activities and shifting to an every five-year reporting cycle once long-term success criteria have been achieved. Each report shall document the condition of each restoration and enhancement area based on monitoring data (including with photographs taken from the same fixed points in the same directions), shall describe the progress towards reaching and/or maintaining the success criteria of the plan, and shall make recommendations, if any, on changes necessary to achieve success. Necessary changes, including identified remediation steps, shall be completed per the timetable identified in any approved report, or within 30 days of report approval where no such timetable is specified.

The Habitat Management Plan shall be implemented concurrent with construction of the approved project, shall be directed by qualified restoration ecologists, and initial Habitat Management Plan implementation activities (including at a minimum initial planting and non-native/invasive plant removal pursuant to the Plan) shall be completed prior to commencement of operation of the approved project.

The Permittee shall undertake development in accordance with the approved Habitat Management Plan.

4. **Agricultural Property Protection.** PRIOR TO CONSTRUCTION OF THE TREATMENT PLANT, the Permittee shall submit evidence to the Executive Director for review and approval indicating that an agricultural conservation easement(s) burdening off-site agricultural property have been granted in perpetuity to the County or another qualifying entity approved by the Executive Director along with adequate funding to compensate for reasonable administrative costs incurred by the easement holder. The easement shall provide agricultural conservation acreage at a ratio of at least 2:1 for the loss of agricultural land associated with the approved project, shall apply to

agricultural land within reasonable proximity of the project site that is of a quality that is reasonably similar to that of the agricultural land lost, and shall be submitted with evidence clearly showing and calculating the amount of agricultural land lost due to the project in closed polygons on site plans and all supporting documentation demonstrating compliance with the requirements of this condition.

5. **Los Osos Basin Recycled Water Management Plan.** PRIOR TO CONSTRUCTION, the Permittee shall submit two copies of a Los Osos Basin Recycled Water Management Plan (Basin Plan) to the Executive Director for review and approval. The objective of the Basin Plan shall be to ensure that implementation of the project, including the sites designated for disposal of the treated effluent, is accomplished in a manner designed to maximize long-term ground and surface water and related resource (including wetlands, streams, creeks, lakes, riparian corridors, marshes, etc.) health and sustainability, including with respect to offsetting seawater intrusion as much as possible, within the Los Osos Groundwater Basin. The Basin Plan shall be structured so as to allow its programs to be developed, and any physical development underlying the implementation of such programs constructed, concurrent with construction of the approved project, and for it to be implemented concurrent with commencement of operation of the approved project. The Basin Plan may be structured to allow phasing if necessary to better achieve Basin Plan objectives. The Basin Plan shall include the following main components:

   a. **Recycled Water Reuse Program.** As reflected in County condition 97, the Recycled Water Reuse Program shall ensure that all tertiary treated recycled water is disposed of in locations within the Los Osos Groundwater Basin that will maximize its ability to meet Basin Plan objectives, where the highest priority for reuse shall be replacing existing potable water use with recycled water use where feasible and appropriate, including with respect to both urban and agricultural reuse. The Reuse Program may include recycled water application at the Broderson leach field (not to exceed 448 afy on an average annual basis) and at the Bayridge leach field (approximately 33 afy or the amount shown to be necessary for maintaining Willow Creek and downstream resources in their pre-project state or better), but it shall prioritize beneficial reuse through (a) developing and installing recycled water connections and entering into delivery/use agreements with urban and agricultural property owners as much as possible, and (b) developing and installing other recycled water delivery systems, in both cases with a priority for locations where such beneficial reuse will go the furthest toward meeting Basin Plan goals. The Reuse Program may include other areas that may be beneficial to the Los Osos Groundwater Basin.

   b. **Water Conservation Program.** The Water Conservation Program required by the County project, which limits indoor water use to no more than 50 gallons per person per day on average within the Basin, shall be incorporated into the Recycled Water Management Plan. The Program shall be designed to help Basin residents to reduce their potable water use as much as possible through measures including but not limited to retrofit and installation of low water use fixtures, and grey water systems. The Program shall include enforceable mechanisms designed to achieve its identified goals, including the 50 gallons per person per day target, and shall include provisions for use of the $5 million committed by the Permittee to initiate water conservation measures pursuant to the Basin Plan as soon as possible following CDP approval. The Permitee shall coordinate with water purveyors to the maximum extent feasible to integrate this conservation program with purveyor implemented outdoor water use reduction measures.

c. **Monitoring Program.** The Monitoring Program shall be designed to quantitatively and qualitatively assess the effectiveness of the Basin Plan over time to ensure its objectives are achieved, and shall include: a baseline physical and ecological assessment of ground and surface water and related resources to be monitored; measurable goals and interim and long-term success criteria for those resources, including at a minimum clear criteria that demonstrate that the health and sustainability of Plan area resources are steadily improving over time, including with respect to seawater intrusion; monitoring provisions, including identification of appropriate representative resource monitoring locations and data types (e.g., groundwater levels and quality; wetland, stream, creek, riparian, and marsh plant and animal abundance, hydrology, and water quality; etc.) and a schedule for proposed monitoring activities. The Monitoring Program shall also include measures to clearly document the manner in which recycled water is being reused and water is being conserved pursuant to the Recycled Water Reuse and Water Conservation Programs.

d. **Reporting and Adaptive Management Program.** Annual reports (two copies) documenting implementation and effectiveness of the Basin Plan shall be submitted to the Executive Director for review and approval by December 31st of each year that the project operates. Each report shall include all monitoring data (including documenting all recycled water reuse for the preceding year, all water conservation efforts and effects, and all resource changes identified), shall describe the progress towards achieving the success criteria of the plan, and shall make recommendations, if any, on changes necessary to better meet Basin Plan objectives and achieve success. On the latter, the annual reports shall be premised upon the concept of adaptive management that responds to information developed and effects better understood over time in association with the project, and is intended to allow for project changes covered by this CDP, unless the Executive Director determines that a CDP amendment is necessary, through the annual report approval process provided that such changes result in better resource protection and better means to achieve Basin Plan objectives over the long-term. Changes, including identified remediation steps, shall be completed per the timetable identified in any approved annual report, or within 30 days of report approval where no such timetable is specified.

The Permittee shall undertake development in accordance with the approved Los Osos Basin Water Recycling Management Plan.

6. **Wastewater Service to Undeveloped Properties.** Wastewater service to undeveloped properties within the service area shall be prohibited unless and until the Estero Area Plan is amended to identify appropriate and sustainable buildout limits, and any appropriate mechanisms to stay within such limits, based on conclusive evidence indicating that adequate water is available to support development of such properties without adverse impacts to ground and surface waters, including wetlands and all related habitats.

7. **Amendment.** All future changes to the approved project, including changes in service area, shall be processed as amendments to this CDP. Any such amendment shall clearly demonstrate the manner in which the amendment would lead to better coastal resource protection, including at a minimum the manner in which it would help to better achieve the goals and meet the success criteria of the approved Los Osos Basin Resource Management Plan (see special condition 5).

8. **Conflict Resolution.** Any differences, conflicts, and/or questions of interpretation between elements of the proposed project description and these conditions shall be resolved in favor of these conditions and in the manner most protective of coastal resources as determined by the Executive Director.

9. **Liability for Costs and Attorneys Fees.** The Permittee shall reimburse the Coastal Commission in full for all Coastal Commission costs and attorneys fees (including but not limited to such costs/fees that are: (1) charged by the Office of the Attorney General; and (2) required by a court) that the Coastal Commission incurs in connection with the defense of any action brought by a party other than the Permittee against the Coastal Commission, its officers, employees, agents, successors and assigns challenging the approval or issuance of this permit, the interpretation and/or enforcement of permit conditions, or any other matter related to this permit. The Permittee shall reimburse the Coastal Commission within 60 days of being informed by the Executive Director of the amount of such costs/fees. The Coastal Commission retains complete authority to conduct and direct the defense of any such action against the Coastal Commission.

California Regional Water Quality Control Board
Central Coast Region

Linda S. Adams
Secretary for Environmental Protection

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Arnold Schwarzenegger
Governor

January 30, 2009

Mr. Mark Hutchinson
Environmental Programs Manager
County of San Luis Obispo, Department of Public Works
County Government Center, Room 207
San Luis Obispo, CA 93408

Dear Mr. Hutchinson:

STATE CLEARING HOUSE NO. 2007121034 REVISED DRAFT ENVIRONEMENTAL IMPACT REPORT: LOS OSOS WASTEWATER PROJECT, SAN LUIS OBISPO COUNTY, CALIFORNIA

Central Coast Regional Water Quality Control Board (Central Coast Water Board) staff has reviewed the County of San Luis Obispo's (County) Draft Environmental Impact Report (DEIR) for the Los Osos Wastewater Project (LOWWP). Thank you for the opportunity to comment on your DEIR. We greatly appreciate the County staff and Board of Supervisors work on solutions for wastewater management in Los Osos. We also appreciate the efforts of citizens who have participated in these County efforts and have contributed their efforts toward a positive result.

We understand that the primary goal of the LOWWP is to construct and operate a community wastewater collection, treatment and disposal system for approximately 15,000 residents, thereby complying with the Water Board's Resolution No. 83-13 (prohibition of waste discharges from individual sewage disposal systems within Los Osos/Baywood Park Area). Eliminating discharges from onsite septic systems, as directed by the Water Board, will also help accomplish the LOWWP's second goal of alleviating groundwater contamination from nitrate that has occurred because of the use of septic systems throughout the community.

The proposed project will consist of three main components: wastewater collection; wastewater treatment, which includes biosolids processing and disposal; and effluent disposal. Central Coast Water Board staff understands that the County is examining four primary alternatives on a coequal basis, as described in Section 3.3.2. of the DEIR. The preferred LOWWP project the county selects could be any one of the four alternatives or a different combination of project components. Central Coast Water Board staff is optimistic that the flexibility to mix and match project components will greatly increase environmental quality of the final wastewater project.

The California Environmental Quality Act requires that an environmental impact report identify the environmentally superior alternative from among the range of alternatives considered. All four of the proposed projects meet the project goals and objectives. However, the County has determined that the environmentally superior alternative is Proposed Project No. 4. Proposed Project 4 consists of a facultative pond treatment plant located at the Tonini property, a gravity collection system, a main pump station located at the Mid-Town site, and spray field disposal at the Tonini property and leach field disposal at the Broderson site.

Water Board staff understands that the DEIR evaluated many potentially significant impacts. With mitigation these potential impacts will not cause additional environmental impacts. However, the DEIR identifies two unmitigatable significant impacts (i.e., agricultural resources and nonrenewable resources), but the improvements in water quality far outweigh impacts that will result for the execution of this project. Central Coast Water Board staff provides the following comments.

Long-Term Maintenance for the Wastewater Treatment Plant

The DEIR lacks a discussion of long term operations and maintenance for the proposed wastewater treatment plant. Central Coast Water Board staff recommends that the final EIR incorporate a discussion of long-term operations and maintenance of the wastewater treatment plant through a public or private agency. It is our experience that secondary or tertiary treatment facilities require a high level of oversight to maintain adequate environmental conditions for superior biological treatment. It is our strong recommendation that community wastewater facilities be owned and operated by public agencies.

Dewatering of Polluted Groundwater Encountered During Construction Activities

Appendix E of the DEIR describes dewatering activities associated with the construction and installation of the wastewater collection system. Although Appendix E discusses the need to enroll in the General National Pollutant Discharge Elimination System Permit for Discharges with Low Threat to Water Quality (Low Threat Permit or Order No. R3-2006-0063) if the County requires dewatering, the County needs to consider the eligibility requirements for such discharges. In other words, if the County encounters groundwater during the construction activities that require dewatering to continue construction, then the County will be responsible for enrolling in the Low Threat Permit or have some other mechanism available to address excess water. The Low Threat Permit requires the discharger to analyze the proposed water for pollutants prior to gaining coverage under the Low Threat Permit and permission to discharge to surface waters. The quality of water proposed for discharging is required to comply with water quality criteria listed in Attachment D of the Low Threat Permit. If these criteria are not met, then the discharge will not be eligible for enrollment under the Low Threat Permit and, therefore, the County may have to address any excess trench water through another method or alternative plan. Even if the water proposed for discharge complies with the water quality criteria in Attachment D, the County will be required to adhere to

the discharge prohibitions, effluent limitations, and monitoring and reporting requirements contained in the permit.

Pipeline Trenching Impacts Associated with the Proposed STEP/STEG Alternative

The DEIR does not describe the trenching or boring depths needed for implementation of the STEP/STEG system described in Proposed Project Alternative No. 1. Project descriptions for all project alternatives explain that pipeline trenching for collection system installation will require a 20-foot wide disturbance area, but does not explain the depth at which this disturbance will occur. Furthermore, we understand that shallower trenching may result in lesser environmental impacts (i.e., ground disturbance, dewatering, etc.). The County should expand on their environmental impact evaluations regarding trenching associated with the installation of the STEP/STEG system as described in Proposed Project Alternative No. 1. This description should discuss potential environmental impacts associated with dewatering activities as a result of deeper versus shallower trenching.

Maintenance Agreement with STEP/STEG Owners

The DEIR does not discuss a mechanism between the County and the private property owners to ensure adequate access and operations and maintenance of the STEP/STEG tanks. Section 2.4.1. of the County's DEIR evaluates two systems for wastewater collection: STEP/STEG and gravity. If a STEP/STEG collection system is chosen for the final project, the County should consider formal legal agreements between the private owners and the County to ensure longevity of the STEP/STEG tanks. Without proper operation and maintenance, the tanks may fail leading to environmental and public impacts. The County should discuss long-term operation and maintenance for the STEP/STEG tanks in the DEIR. Even though the preferred project is a gravity collection system, there are likely individual lots or neighborhoods where a STEP/STEG or other type of pumped system will be needed.

Salt Management for Proposed Disposal Areas

Salt management is important in addressing the potential impacts for salt accumulation in groundwater aquifers. The only discussion of salt management in Section 2.4 (Project Components) and Section 5.2 (Groundwater Resources – Cumulative Impacts) of the DEIR, is regarding saltwater intrusion. The DEIR does not discuss potential salt accumulation due to the continuous disposal of wastewater in a designated location, specifically, spray field irrigation at the Tonini property and at the leach field at the Broderson site. Salt buildup in upper groundwater aquifers is a common problem in the Central Coast Region due to a mixture of agricultural irrigation practices and land disposal of treated wastewater. Excessive salt build up in groundwater aquifers has the potential to render the aquifer useless for future agricultural or domestic supply water use.

Section 5.2.1. (Environmental Setting) of the DEIR states that "The areas of the basin with higher TDS concentrations in shallow groundwater have been found to correspond

roughly to some of the areas of higher NO3-N (nitrate) concentrations. This may result from brine reject from domestic water softeners or other normal salt loading from domestic water use that is subsequently discharged from septic disposal systems." This suggests that salts from the treated wastewater might be an issue; especially if these treated wastewater flows are concentrated in a specific location (i.e., Tonini property and Broderson site).

Section VIII.C.4 of the Central Coast Water Quality Control Plan (Basin Plan) discusses the need for salt management and improved salt management techniques. Some suggestions provided in Section VIII.C.4 of the Basin Plan include using wet weather storage reservoirs to dilute groundwater, improving the quality/quantity of the groundwater aquifer. Also, this section discusses the use of drainage wells which divert rainwater to salt sinks in order to increase dilution.

Although these techniques may not be required, we anticipate that salt management would be a component of wastewater operations. Water Board staff will consider incorporating requirements for salt management in our waste discharge requirements.

Designing the Leach Field at the Broderson Site

In many instances, leach field systems are constructed with inadequate design considerations, which can lead to odors or nuisance, surfacing effluent, disease transmission, and pollution of surface water or groundwater. The DEIR did not discuss the design of the leach field disposal system. This evaluation should include consideration of capacity dependant on estimated build-out, peak daily flows (including the consideration of using spray fields at the Tonini property), consideration of inflow/infiltration, development of a maintenance manual, consideration for nitrogen loading, setbacks from domestic supply wells, and other requirements. These issues and requirements must be included in the final project proposal prior to the issuance of waste discharge requirements.

Broderson Site Stormwater Capture, Disposal Rate Monitoring and Mitigation, and Increased Potential for Liquefaction

Appendix E-1, Section 5.3 of the DEIR states that "[t]he leachfields would be designed so that stormwater runoff does not leave the site. Grading would contour the earth to ensure that runoff passes into the leach trenches and infiltrates to the groundwater below." This concept is consistent with Section VIII.C.4 of the Basin Plan/Salt Management as mentioned above. However, since stormwater capture will be designed to assure that precipitation runoff will not move down slope of the site, the County needs to explain the potential impacts of increased percolation levels to the perched aquifer (e.g., liquefaction zone present in the 5 to 10 feet below ground surface) associated with the stormwater capture design.

The DEIR explains that monitoring changes in groundwater levels down gradient of the Broderson site will assure that any changes "will remain less than significant." However, the DEIR fails to present a mitigation plan describing the best methods to

respond to incremental changes in groundwater levels that would allow for continued safe use of the disposal fields relative to potential destabilizing the hillside below the Broderson site, increasing liquefaction potential or limiting the amount of unsaturated soil available for effluent treatment.

The DEIR does not to provide discussion on mitigation for disposal design for Waste Water Treatment Plant Operations should monitoring data show that changes in the groundwater levels require a decreased disposal rate for the Broderson site. The EIR states that monitoring will occur to determine if the Broderson site could safely increase the level of disposal operations. However, no discussion is presented to state how the plant operations will be conducted if the Broderson site disposal rates must be decreased due to destabilization of the hillside below the disposal site. Since the Broderson site is a critical component of all four project alternatives, and because it needs to be designed to accept disposal year-round, including during the rainy season, the County should explain how disposal operations will be affected and what potential options will be available to replace any required reduction in disposal levels at Broderson.

Water Board staff will evaluate the County's waste discharge application to ensure compliance with Basin Plan design criteria, siting criteria, disposal monitoring, and associated operations and management procedures for the proposed the Broderson site leach field system. Staff will consider incorporating requirements that are specific to the design and management of the proposed disposal system.

Effluent Quality

Please describe design/expected nitrogen concentrations in the effluent from the various treatment methods. Page 3-57 says a separate nitrogen removal process is required for Proposed Project No. 4, what is it and what are the expected monthly average and daily maximums? What is the margin of safety for meeting effluent requirements? Note that Table 2-1 should refer to Biochemical rather than Biological Oxygen Demand.

Incidental Runoff from Spray Disposal

Incidental runoff refers to runoff due to sprinkler over-spray that leaves the intended and permitted disposal area. Incidental runoff of treated wastewater to surface waters is prohibited without proper permitting. Incidental runoff may occur from over watering, pipe leaks, improper maintenance, and/or irrigation during wet weather events. Incidental runoff discharges into surface waters can lead to nuisance, surface water contamination, and impacts to aquatic life. We expect the development of long-term operations and maintenance protocols to adequately manage spray disposal activities. Central Coast Water Board staff will incorporate prohibitions for unpermitted discharges of treated wastewater to surface waters in our waste discharge requirements.

Existing Septic System Abandonment

The DEIR briefly discusses abandonment of the existing septic systems, which will be a major component of the LOWWP. According to Section 3.4.2. (Septic Tank Abandonment) of the DEIR, "the SLOC [San Luis Obispo County] Department of Planning and Building requires that the private property owners pump out abandoned septic tanks and provide a copy of the receipt for pumping to the area inspector. According to the SWRCB National Pollution [sic] Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction Activity (Water Quality Order 99-08-DWQ), removing the abandoned tanks will require preparing a Storm Water Pollution Prevention Plan (SWPPP) as described above. The County will prepare a SWPPP for the entire project, including LOWWP construction and both publicly and privately financed related actions that are required such as septic tank abandonment."

The above statement alludes to removing the existing septic systems by excavation. Water Board staff foresees potentially major environmental impacts (i.e., stormwater, groundwater, etc.) from the removal of approximately 15,000 septic systems by excavation. Although a SWPPP will be required for projects that disturb one acre or greater, the combined impacts from the removal of 15,000 septic systems might not be mitigated through the implementation of a SWPPP.

Another option for abandonment of existing septic systems might include in-place abandonment. It appears that San Luis Obispo County Ordinance Title 19.01.040 makes reference to septic tank abandonment requirements of the California Plumbing Code (Appendix K.11.b.). This code allows abandoning septic systems in-place rather than excavation. This option should be considered as it might yield less disturbance to the surrounding environment and be less of a financial burden on Los Osos residents.

We recommend that the County address potential septic system abandonment alternatives (e.g., abandon in place), potential environmental impacts of septic tank removals, and associated costs for abandonment.

Stormwater Municipal Permit

The County is currently subject to the National Pollutant Discharge Elimination System (NPDES) Phase II Municipal Stormwater Permit (General Permit). As part of its responsibility, the Central Coast Water Board must determine permittees' compliance with General Permit requirements. This includes determining whether municipalities have reduced pollutant discharges to the Maximum Extent Practicable (MEP)[1]. The MEP standard is an ever-evolving and flexible standard which balances technical feasibility, cost, effectiveness, and public acceptance. The General Permit requires permittees to prevent or minimize water quality impacts from new development and

[1] "Permittees must implement Best Management Practices (BMPs) that reduce pollutants in storm water runoff to the technology-based standard of Maximum Extent Practicable (MEP) to protect water quality." Effluent Limitations, General Permit Fact Sheet, pg. 6.

redevelopment projects[2]. The volume and velocity of storm water discharged from impervious surfaces can cause increased bank erosion and downstream sedimentation, scouring, and channel widening which significantly impact aquatic ecosystems and degrade water quality. The County Storm Water Management Programs (SWMP) is required to address how new and re-developments maintain pre-development hydrologic characteristics, such as flow patterns, surface retention, and recharge rates in order to minimize post-development runoff impacts from the LOWWP. In most cases, MEP standards are not met by conventional site layouts, construction methods, and storm water conveyance systems with "end of pipe" basins and treatment systems that do not address the changes in volume and rates of storm water runoff and urban pollutants (including thermal pollution). Low Impact Development (LID) practices meet the MEP standard and are more effective at reducing pollutants in storm water runoff at a practicable cost.

LID is an alternative site design strategy that uses natural and engineered infiltration and storage techniques to control stormwater runoff where it is generated. The objective is to disperse LID devices uniformly across a site to minimize runoff. LID serves to preserve the hydrologic and environmental functions altered by conventional stormwater management. LID methods provide temporary retention areas, increase infiltration, allow for pollutant removal and control the release of stormwater into adjacent waterways (Anne Guillette, Whole Building Design Guide). For further reference please see:

http://www.epa.gov/owow/nps/lid/

Eight Common LID Practices Include:

1. Reduced and Disconnected Impervious Surfaces
2. Native Vegetation Preservation
3. Bioretention
4. Tree Boxes to Capture and Infiltrate Street Runoff
5. Vegetated Swales, Buffers, and Strips
6. Roof Leader Flows Directed to Planter Boxes and Other Vegetated Areas
7. Permeable Pavement
8. Soil Amendments to Increase Infiltration Rates

Water Board staff considers a project that meets the following descriptions (inclusive) to be a "Low Impact Development" project:

A. Runoff Volume Control. The pre-development stormwater runoff volume is maintained by a combination of minimizing the site disturbance, and providing distributed retention BMPs. Retention BMPs are structures that retain the excess (above pre-development project volumes) runoff resulting from the development for the design storm event (2-, 10-, and 25-year, 24-hour duration storm). Note that "retention" is required, as opposed to "detention"; retention may be achieved using infiltration methods, and capture-for-use methods.

[2] "Post-Construction Storm Water Management in new Development and Redevelopment – The Permittee must: 1) Develop, implement, and enforce a program to address storm water runoff from new development and redevelopment projects...by ensuring that controls are in place that would prevent or minimize water quality impacts", General Permit, pg 11, Provision e.1.

B. Peak Runoff Rate Control. Low impact development practices maintain the pre-development peak runoff discharge rate. This is done by maintaining the pre-development time of concentration and then using retention and/or detention BMPs (e.g., rain gardens, open drainage systems, etc.) that are distributed throughout the site, to control runoff volume. If retention practices are not sufficient to control the peak runoff rate, detention practices may be added.

C. Flow Frequency Duration Control. Since low impact development emulates the pre-development hydrologic regime through both volume and peak runoff rate controls, the flow frequency and duration of post-development conditions must be identical (to the greatest extent possible) to those of pre-development conditions. Maintaining pre-development hydrologic conditions will minimize or eliminate potential impacts on downstream habitat due to erosion and sedimentation.

Permittees must, therefore, incorporate LID methodology into new and redevelopment ordinances and design standards unless permittees can demonstrate that conventional BMPs are equally effective, or that conventional BMPs would result in a substantial cost savings while still adequately protecting water quality and reducing discharge volume. In order to justify using conventional BMPs based on cost, permittees must show that the cost of low impact development would be prohibitive because the "cost would exceed any benefit to be derived." (State Water Resources Control Board Order No. WQ 2000-11.). Low Impact Development techniques must be included as mitigations in the final EIR for this project.

We welcome the opportunity to meet with County staff to discuss both wastewater and stormwater issues as the project evolves. If you have questions, please contact **David LaCaro at (805) 549-3892** or at dlacaro@waterboards.ca.gov.

Sincerely;

Roger W. Briggs
Executive Officer

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Reduced use for 2 years as the leach-fields are tested

annual application rate not exceed 448 AFY. Exceeding this rate could cause the water table to rise near the bay front and require installing harvest wells downstream to keep the water table from rising unacceptably.

Broderson leach fields

When the LOWWP is first completed and begins operation, the estimated total treated effluent will be approximately 200 AFY less than the total treated effluent forecast at buildout. This will allow the LOWWP flexibility to apply about 250 AFY to the leachfield and monitor the effects on the groundwater using the monitoring wells that have already been installed.

The Broderson site would be accessed by a gravel road that extends south from the end of Broderson Avenue as shown on Exhibits 3-6 through 3-9. The site would require fencing to limit public access since the treated effluent would meet secondary but not the more stringent Title 22 tertiary standards for recycled water. The 8-acre active leachfield area at the Broderson site would be excavated to an average depth of 6.5 feet during construction, backfilled with a 4-foot layer of gravel for drainage, and then covered by geotextile fabric. Final cover would consist of a minimum of 2.5 feet of native soil backfill. The percolation piping would consist of 4-inch perforated PVC pipe laid approximately one foot below the geotextile fabric layer, with the perforations facing upwards. If the pores beneath the leachfield become clogged over time, the leachfield would be excavated and the ground beneath it would be ripped or disked. The estimated frequency of ripping ranges between 5 and 10 years (Appendix B, Project Description Data, and Carollo April 2008b).

5-10 year re-excavating and ripping

Sprayfields

Sprayfield disposal is the practice of spraying effluent on land to dispose of the water through evapotranspiration and percolation. Sprayfield disposal, which requires secondary treatment, would be operated to maximize evaporation and minimize runoff. This would entail spraying only during the daytime and collecting any tailwater (runoff) that does occur and returning it to the sprayfields for reapplication. Disposal would occur through evapotranspiration (ET), or through both evapotranspiration and percolation. The estimated capacity for sprayfield land that is suitable for both ET and percolation is 4.8 AFY per acre, and the estimated capacity for sprayfield land that is suitable for ET only is 3.0 AFY per acre. Approximately 175 acres of sprayfield are expected to be needed for Proposed Projects 1 through 4 and the actual split between land that is suitable for ET and percolation and land that is suitable for ET only will be determined as part of the design process.

The two effluent disposal options of sprayfields and the Broderson leachfield, plus water conservation would provide sufficient capacity for the 1,290 AFY of effluent that are projected for the LOWWP at buildout as shown in Table 3-5. During the wet winter months, the sprayfields would not be active. If the daily treated effluent flow exceeds the Broderson leachfield capacity, the effluent could be stored in the 46-acre pond until spring after the wet weather and high runoff periods are over.

Treated effluent from the treatment facility would be pumped to the Tonini property through a pressurized pipeline known as the treated effluent conveyance system. The irrigation lines to the

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- Project Design Feature 5.3.A-5 has been modified to indicate that the nearest sprayfield sprayheads would be located at least 100 feet from the upper extent of the wetland. Spray heads near the 100-foot buffer zones will have a 180-degree or smaller spray range focused inward towards the sprayfield so that no direct spray reaches the buffer zones.
- Project Design Feature 5.3.A-6 specified that berms would be constructed parallel to existing onsite drainages; they have been deleted from the project description because the lower application rates associated with ET and the protection provided by the 100-foot buffer zones make them unnecessary.

Creek Crossings

The Preferred Project creek crossing locations will be the same as those anticipated for Proposed Project 4, but the open cut installation has been eliminated. As shown in Exhibit Q.3-1, the raw wastewater and treated effluent conveyance pipelines will cross Los Osos Creek and several other drainages under Los Osos Valley Road and Turri Road. The existing pipe sleeve through the south side of the Los Osos Valley Road bridge across Los Osos Creek will be used for the 12-inch treated effluent conveyance pipeline. Conventional pipe hangers will be used to suspend the 14- to 16-inch raw wastewater conveyance pipeline from the north side of the Los Osos Valley Road bridge across Los Osos Creek. Similarly, conventional pipe hangers will be installed to suspend the raw wastewater and treated effluent pipelines across the Turri Road bridge crossing of Warden Creek.

Exhibit Q.3-2 provides more detail on the creek crossing locations on the Tonini WWTP and sprayfield site. These creek crossings will be constructed using open cuts and placing at least 5 feet of cover over the raw wastewater pipelines and at least 3 feet of cover over the treated effluent pipelines.

Broderson Leachfield Refinements

Hydrogeologists on the LOWWP team have continued to develop the Broderson leachfield effluent disposal program. The operational plan, groundwater monitoring program and surface stormwater runoff plans have been developed further as discussed below.

Operational Plan

Beginning at least 24 hours before forecasted storm events, which primarily occur during the wet winter season, all of the LOWWP treated effluent will be directed to the wet weather storage ponds and/or the Broderson leachfields. During dry weather, the majority of the treated effluent will be directed to the Tonini sprayfields with lesser amounts conveyed to the Broderson leachfields. The planned operational scenario at Broderson is to operate the disposal leachfields at a rate of up to 800,000 gallons per day (gpd), disposing of a maximum of 448 ac-ft of effluent at Broderson during the entire year. At 800,000 gpd, which is equivalent to 3.1 gpd per square foot of active leachfield area, the fields would be operating at less than 2 percent of the maximum tested infiltration rate of 180 gpd per square foot of leachfield area (Cleath and Associates 2000). For the first two to three

Different from DEIR

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years of operation, LOWWP operators expect to limit total disposal at Broderson to 200 AFY to verify the results of the various hydrogeological studies. This can be accomplished because the community is not at buildout.

Less than in DEIR.

Monitoring Wells

The plan for Broderson leachfield groundwater level monitoring is to install five vadose-zone (shallow) monitoring wells, each one consisting of three piezometers clustered in a single 10-inch borehole. As shown in Exhibit Q.3-1, two of the wells are immediately below the leachfield, a third is between the leachfield and Highland Avenue, and the last two are in the right-of-way on Highland Avenue. These five vadose zone cluster wells (15 individual piezometers) are for monitoring potential perched water lenses up to 40 feet deep. In addition, existing deeper monitoring wells will allow the LOWWP operators to monitor development of the primary mound which will develop on the regional clay aquitard.

In addition, there will be a need to monitor development of the primary mound which will develop on the regional clay aquitard. These deeper monitoring wells are already in place. (Cleath and Associates, 2009) The groundwater monitoring program will also monitor project impacts on surface water features using the extensive number of existing water quality monitoring and water supply wells throughout the Los Osos community.

Stormwater Runoff

Project Design Feature 5.7.B-2 specified that berms would be constructed around the Broderson leachfields in locations where they would allow potential effluent runoff during storm events to be captured and allowed to infiltrate. This project design feature has been deleted from the project description because the treated effluent discharge rates will prevent effluent from surfacing at the Broderson site. During and after the initial leachfield construction and periodic rehabilitation of portions of the leachfields, , Best Management Practices will be used to control surface erosion from the site until the revegetation process is complete.

Water Conservation Measures

The Preferred Project's water conservation measures were derived from the Los Osos Community Services District 2000 Urban Water Conservation Plan (LOCSD 2000). With a target 10 percent per capita water demand reduction and a corresponding 10 percent wastewater generation reduction by 2020, the LOWWP's primary water conservation measure is requiring bathroom retrofits with low-flow fixtures , including toilets, prior to connecting to the new sewer. Additional water conservation will be obtained through a public education program and promoting high-efficiency appliances. If a 10 percent water conservation rate is not obtained with the existing water conservation measures, then the LOWWP would implement additional water conservation measures in coordination with the water purveyors to achieve the target conservation rate.

c. Recycled Water Reuse: Recycled wastewater will be reused within the community or surrounding agricultural land overlying the groundwater basin according the approved conditions of the Coastal Development Permit. It will either be discharged through leachfields or directly reused for urban or agricultural irrigation. The reuse program will consist of the following:

- 50 acre-feet of storage at the treatment plant site
- A recycled water main running from the treatment plant site, through the adjacent agricultural area, to reuse sites within the community
- 8 acres of leachfields at the Broderson site, with an annual capacity of 450 acre-feet
- Utilize one acre of existing leachfieds in the Bayridge Estates sub-division with an annual capacity of 33 acre-feet
- Provide approximately 130 acre-feet of recycled water to Los Osos schools, parks, golf course, and cemetery
- Provide recycled water main turn-outs to adjacent farmlands and develop reuse agreements for approximately 100 to 200 acre-feet per year

This does not provide for 200-250 AFY less water going to Broderson for 2-3 years as they are tested - (see pp. 1-3 of this attachment)

This plan will not mitigate seawater intrusion and also supply ground water flows to habitat (200-300 AFY) (see Attachmt 20).

The approved reuse program includes capacity to meet the flows from existing development that will connect to the system at project start-up. Connection of additional users, from currently undeveloped property, is specifically prohibited in the Coastal Development Permit, until certain conditions are met. These conditions include the requirement to develop a habitat conservation plan for Los Osos, develop a water management plan, and update the Local Coastal Plan to incorporate the habitat and water plans. Reuse capacity for the additional flows associated with new development is not necessary at project start-up, due to these conditions. The Coastal permit conditions effectively require a water management plan to identify the most beneficial reuse alternatives for the additional flows associated with new development, prior to any new connections to the system. The layout of the recycled water reuse sites is provided in Figure 4.1 (Project Diagram).

d. Water Conservation Program: A water conservation program will be implemented with residential and commercial fixture retrofits, appliance rebates, education, and water efficiency audits. The goal of the conservation program is to reduce indoor use by over 25% to 50 gallons per capita per day. The water conservation program will result in decreased demand on system facilities such as pump stations and treatment works, increase the operating life of the facilities, and increase operational flexibility.

This is not measurable

However I/I at 300,000 gpd will offset the benefit of conservation (see Attachment 25, p. 9)

Appendix Q:
Preferred Project Environmental Evaluation

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bedrock (if encountered). Groundwater and soil moisture conditions will fluctuate seasonally, and as a result of changes in precipitation, storm runoff, irrigation schedules, and other factors.

3.5 SEISMIC CONDITIONS

3.5.1 Historical Seismicity

The project is located in a seismically active region of central California. Historical records indicate that the area has been subject to various seismic events over the last 183 years (PG&E, 1988). A summary of Magnitude 2 and greater seismic events recorded from 1933 through March 2008 are presented on Plate 6 - Historical Seismicity Map. From these references, examples of relatively strong ground motion that has reportedly been experienced near the project area are the seismic events of 1830, 1857, 1913, 1916, 1917, 1966, 1980, and 2003.

The 1830 event is estimated to be an approximately M5 earthquake that occurred from a poorly located source near San Luis Obispo. The effects of the 1830 event were generally observed between the Los Osos and Rinconada faults. The 1857 event (the Fort Tejon earthquake) occurred on the Mojave segment of the San Andreas fault, and reportedly resulted in damage in central and southern California. The 1913 event is estimated to be an approximately M5 earthquake that occurred along the southwestern margin of the San Luis/Pismo block near Arroyo Grande. The 1916 event is estimated to be an approximately M5 earthquake that occurred near Avila, possibly along the Los Osos fault or faults along the southwestern margin of the San Luis/Pismo block. The 1917 event is estimated to be an approximately M5 earthquake that occurred near Lopez Canyon between the Rinconada and West Huasna faults. The 1966 event (the Parkfield earthquake) is estimated to be an approximately M6 earthquake that occurred on the San Andreas fault. The 1980 event is estimated to be an approximately M5 earthquake that occurred offshore near Point Sal along the Casmalia fault zone, and near its intersection with the Hosgri fault. The 2003 event (the San Simeon earthquake) is estimated to have been a M6.5 earthquake resulting in a ground acceleration of about 0.18g in the project vicinity (U.S. Geologic Survey 2004). The epicenter of the 2003 earthquake was located approximately 25 miles north of the site, near the Nacimiento fault zone.

3.5.2 Seismic Hazard Analysis

A preliminary probabilistic seismic hazard evaluation for the project vicinity was performed using the web-based interactive National Seismic Hazard Map program (U.S. Geologic Survey, 2008). The intent of our evaluation was to estimate the range of strong ground motions that could result from earthquakes occurring on active and potentially active faults. Crustal source and subduction source ground motions are calculated within a 200-kilometer (km) and 1,000-km radius of the project vicinity, respectively. Maps depicting the estimated peak horizontal ground motion and estimated spectral accelerations for 0.2 second (s) and 1.0s periods were used to estimate ranges within the project vicinity. Ground motions are calculated for a suite of attenuation relationships and combined using a weighted logic tree analysis (Peterson et al., 2008). The ground motions are approximated for a reference site

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corresponding to the boundary between NEHRP Site Classes "B" and "C" (average shear wave velocity of 760 meters per second in the upper 30 meters of the crust). Estimated ground motions corresponding to a 2 percent probability of being exceeded in 50 years (statistical return period ≈ 2,475 Years) are tabulated below.

Hazard Level	Peak Horizontal Acceleration	0.2 Second Period Horizontal Acceleration	1.0 Second Period Horizontal Acceleration
2% Probability of Exceedance in 50 years	0.4 – 0.6	1.01 – 1.6	0.31 – 0.5

Note: All acceleration values in units of g (32 ft/sec2 or 9.81 m/s2)

Based on the geology of the project vicinity and subsurface conditions encountered in previous exploration programs, we anticipate the majority of sites will be classified as site class "D". This soil profile type corresponds to a stiff soil profile according to the CBC (2007). A site class "D" assumes that the material in the upper 100 feet of the site has an average shear wave velocity ranging between 600 and 1,200 feet per second (180 and 360 meters per second). However, based on review of geologic maps (see Plate 3) portions of the collection area are underlain by sediments that have been identified as having a potential for liquefaction. Exploration has not been performed for the Tonini and Turri Road sites; however, the sites are mapped as being underlain by alluvium that can be vulnerable to liquefaction. According to the ASCE (2005) design code and the CBC (2007), "soils vulnerable to potential failure or collapse under seismic loading, such as liquefiable soils…and collapsible weakly cemented soils" shall be classified as site class "F" and require a site-specific response analysis. It should be noted that a site-specific response analysis is not required for structures having fundamental periods of vibration equal to or less than 0.5s, according to section 20.3.1 of the ASCE (2005) design code.

3.6 LIQUEFACTION CONDITIONS

Liquefaction is a sudden loss of soil strength due to rapid increases in pore water pressures caused by seismic shaking. Liquefaction typically occurs during an earthquake in unconsolidated loose to medium dense sandy soils that are below the groundwater table. The potential and severity of liquefaction will depend on the intensity and duration of the strong ground motion, the depth to groundwater, the soil type, and terrain in the area where liquefaction occurs. Seismically induced settlement, collapse, or lateral spreads can occur in soils that are loose, soft, or that are moderately dense and weakly cemented, or in association with liquefaction.

3.6.1 San Simeon Earthquake

We reviewed selected areas of the project site on the afternoon following the December 22, 2003 magnitude M6.5 San Simeon earthquake to observe whether or not there was evidence of liquefaction or other earthquake damage. The epicenter of the earthquake was located approximately 25 miles north of the site, and is estimated to have resulted in a ground acceleration of 0.18g in the project vicinity (USGS 2004). We visited the low-lying areas of the

collection system, Mid-Town site, and pump station locations. Evidence of liquefaction was observed along shorelines of Morro Bay and Cuesta Inlet. Liquefaction was manifested as sand that had ejected around the pilings that support the Baywood T-pier, numerous sand boils and mud volcanoes on the shore of Morro Bay mainly below the high-tide line, and lateral spreads, pipes, and fissures along the shoreline of Cuesta Inlet. The liquefaction appeared to be constrained to near the shoreline, and did not visually appear to have seriously impacted the adjacent roadways or infrastructure such as may have been evidenced by cracks, fissures, or differential settlement.

The liquefaction appears to have occurred within a relatively shallow layer of loose sand that was encountered in previous exploration programs. We did not observe evidence of liquefaction or differential seismic settlement at the higher elevations of the prospective project sites such as at the Mid-Town, Broderson, effluent disposal sites, nor at the pump station sites that were typically located away from the shoreline.

The manifestation and damage that can be associated with liquefaction is strongly dependent on the duration of the ground motion. Larger magnitude earthquakes typically result in longer periods of shaking. Earthquakes that occur closer to a site generally result in higher ground motions than a similar magnitude earthquake that could occur away from the site. The design earthquake ground motion is likely to be higher than the San Simeon earthquake ground motion (0.4g to 0.6g vs. 0.18g).

3.6.2 Liquefaction

The Safety Element of the San Luis Obispo County General Plan (1999) identifies areas where the potential for liquefaction should be evaluated based on mapping of geologic formations that may contain soil types susceptible to liquefaction. Within the Los Osos area, the Safety Element identifies geologic units such as beach sand, dune sand, and younger alluvial deposits as having a high potential to contain sediments that may be prone to liquefaction. Based on review of geologic maps (see Plate 2), all the sites under consideration for the project are completely or partially underlain by geologic units that may contain sediments susceptible to liquefaction. The previous geotechnical data available for the sites and presented in the Fugro (2004a, 2004b, and 2007) reports was used to further characterize the potential for liquefaction to impact the project considering the soil types encountered within the various geologic units, the relative density of the soil, and the depth to groundwater. A summary of the liquefaction hazard for the project is presented on Plate 7 – Liquefaction Hazards Map. The varying potential for liquefaction shown on the map is presented below:

- Very High. Groundwater has been encountered within about 10 feet of the ground surface, soil units previously encountered are loose and vulnerable to liquefaction, and/or manifestation of liquefaction was observed following the 2003 San Simeon earthquake.
- High. Groundwater is present within about 50 feet of ground surface and previous explorations suggest sediments are loose and prone to liquefaction. The depth of potentially liquefiable material may be limited or near the groundwater table.

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- Moderate. Groundwater is present within about 50 feet of ground surface, and previous explorations suggest sediments are medium dense and prone to liquefaction, or geologic units may contain sediments susceptible to liquefaction, but the area was not evaluated by the previous studies.
- Low. Groundwater likely not present within 50 feet of ground surface or sediments in this vicinity were previously evaluated and found to be dense and have a low potential for liquefaction.
- Not indicated. Bedrock or formation units that are not considered vulnerable to liquefaction.

4.0 GEOLOGIC HAZARD IMPACTS

The following sections present a summary of geologic hazards that we evaluated for the project, our opinion regarding the potential for the hazards to impact the project, and preliminary recommendations for mitigation of the hazard, if needed. Prospective agricultural and urban reuse sites were not evaluated for geologic hazard impacts, as irrigation with reuse water is not anticipated to represent a change in current land use or influence impacts from geologic hazards.

4.1 FAULT RUPTURE

Fault rupture is the displacement of the ground surface created by movement along a fault plane during an earthquake. A fault rupture hazard can exist when structures or facilities or are located directly on an active fault, and rupture of that fault could displace the ground surface upon which the building or facility is located. The State of California precludes building on active faults under Alquist-Priolo Earthquake Fault Zoning Act. The Alquist-Priolo Earthquake Fault Zoning Act's main purpose is to prevent the construction of buildings used for human occupancy on the surface trace of active faults.

As shown on Plate 4, prospective project sites are not located within a designated Alquist-Priolo Earthquake Fault Hazard Zone. As discussed in Section 3.2 of this report, the closest mapped active fault to the project vicinity is the Irish Hills segment of the Los Osos fault mapped approximately ½ miles or more south of the project vicinity. Therefore, the potential for fault rupture to impact the project site is considered low, and no mitigation for fault rupture is needed.

Mitigation: None anticipated.

4.2 STRONG GROUND MOTION

Strong ground motion (shaking) can occur in response to local or regional earthquakes. The project site is located within a seismically active area. The potential exists for strong ground motion to affect the project during the design lifetime. In general, the primary effects will be those phenomena associated with shaking and/or ground acceleration. Those effects can be mitigated through appropriate design and construction procedures.

The building code requires that structures be designed to resist design earthquake strong ground motions. The ASCE (2005) design code and the California Building Code (CBC 2007) require buildings to be designed for earthquake effects that are two-thirds ($^2/_3$) of the corresponding Maximum Considered Earthquake (MCE) effects. As discussed in Section 3.5 of this report, the estimated MCE ground motions are site class-modified spectral accelerations corresponding to earthquakes estimated to have a 2 percent chance of being exceeded in 50 years, or a return period of about 2,475 years. Design earthquake ground motions for liquefaction and other geotechnical analyses are defined as two-thirds ($^2/_3$) of the corresponding MCE ground motions. Structural designs are based on the 0.2s and 1.0s period spectral accelerations corresponding to the MCE for a Site Class "B" (site class is defined per ASCE [2005], CBC [2007]) which are modified, if necessary, to account for different Site Class effects.

Mitigation: The proposed structures should be designed to resist the lateral forces generated by earthquake shaking in accordance with building code requirements. Seismic data and site classification for the design of structures should be provided in the design-level Geotechnical Report in accordance with applicable building codes and subsurface exploration. The report should also provide ground motion parameters (magnitude and peak ground acceleration) for use in geotechnical analyses, such as for evaluating slope stability, liquefaction, and seismic settlement.

4.3 SEISMIC-RELATED GROUND FAILURE

4.3.1 Liquefaction and Seismic Settlement

As noted above, all the sites under consideration for the project are completely or partially underlain by geologic units that may contain sediments susceptible to liquefaction. However, previous site-specific analysis of liquefaction shows that not all of the mapped units are potentially liquefiable. The potential for liquefaction hazards to impact each prospective site is summarized below, and shown on Plate 7. The following information is based on previous investigations by Fugro (2004a, 2004b, 2007), visits to particular sites and review of geologic maps and literature.

Soils within the project vicinity vary from soils having a relatively low to high potential for liquefaction. Soils having a high to very high potential for liquefaction were typically encountered in the collection system area by our previous investigation (Fugro, 2004a). The greatest potential for liquefaction is within areas that are either low in elevation, such as the shoreline areas along Morro Bay and interdunal depressions along Morro Avenue, Paso Robles Avenue, Santa Ynez Avenue, and Ramona Avenue-Mitchell Drive. These areas are typically characterized as being underlain by relatively loose sand and shallow groundwater. The potentially liquefiable sand is typically less than 10 feet thick. The piping and pump stations that will be located in these areas are the most likely to be impacted by liquefaction. Soils having a low potential for liquefaction were generally encountered in the higher elevations of the site, such as the predominant dune ridges along Pismo Avenue, eastern Santa Maria-El Morro Avenue, and in the Broderson-Skyline Avenue area. These areas are typically characterized as being underlain by relatively dense sand, and/or areas where groundwater is deep relative to the presumed depth of the collection system.

In addition, soils having a moderate to high potential for liquefaction are mapped within the recent, unconsolidated dune sand and alluvial sediments associated with Los Osos Valley drainage, Los Osos Creek, and Warden Lake. Based on the low relief of these areas, we anticipate high groundwater elevations to augment the susceptibility of the alluvial soils to liquefaction. These areas are most likely to impact the conveyance pipelines that may traverse these low lying areas.

In general, dune sand and alluvial sediments are underlain by soils of the Paso Robles Formation within the project vicinity. The Paso Robles Formation is typically equivalent to stiff to hard and dense to very dense soil, thus, the majority of sites underlain by the Paso Robles Formation, have a low potential for liquefaction. Bedrock units of the Franciscan Formation are not considered susceptible to liquefaction. The treatment plant improvements and Broderson sites are located in areas that are considered to have a low potential for liquefaction, except for perhaps the Turri Road and Tonini treatment plant sites where subsurface exploration to help evaluate liquefaction hazards has not been performed. Based on site reconnaissance, the majority of the Tonini site appears to have relatively shallow soil cover overlying Paso Robles Formation or Franciscan rocks, and a site for the treatment facility could likely be selected in the bedrock areas and outside any areas that may be vulnerable to liquefaction.

4.3.1.1 Collection System and Conveyance Network

Liquefaction can result in ground mobility that impacts pipeline grades, or results in pipelines floating out of the ground in areas of liquefaction. The collection system will consist of approximately 45 miles of pipeline that will essentially be constructed through the Los Osos, Cuesta-by-the-Sea and Baywood communities. Loose sand blankets the upper 5 to 10 feet of the ground surface over most of the collection system area. Portions of the collection system network and prospective out-of-town/in-town conveyance routes traverse areas having a relatively high potential for liquefaction. The potential for liquefaction and seismic settlement to impact pipelines may be governed by the depth of the pipeline relative to the depth of liquefiable soils. For our previous investigation (Fugro, 2004), the seismic settlement within the collection area was estimated to be less than about 2 inches.

Mitigation. Liquefaction could impact the pump station and pipelines in portions (about 20 percent) of the collection system areas, and where the conveyance crosses low-lying areas or creeks. Mitigation for pump stations typically consists of site preparation and grading that will reduce the potential for liquefaction and seismic settlement to impact the pump station areas, or supporting the structure on deep foundations bearing below the liquefiable materials. Specific recommendations for designing pump stations considering liquefaction hazards should be provided in the design-level geotechnical report.

When practical, pipelines should be founded below liquefiable soils. Because of the difficulty of predicting pipeline performance relative to liquefaction and seismic hazards, pipelines are commonly not mitigated as part of the design and construction of a pipeline project. Alternatively, liquefaction and seismic hazards can be addressed in an Emergency Response Plan (ERP) for the wastewater facility. The ERP should recognize the potential for liquefaction and seismic hazards to impact the pipeline, and specific high hazard areas that

should be inspected for damage following an earthquake. "Soft fixes" are sometimes incorporated in the ERP. Soft fixes typically consist of having a plan in-place to address the hazards, such as can be achieved by storing supplies and equipment associated with the pipeline and repair that can be difficult to obtain or have long lead times to obtain.

4.3.1.2 Wastewater Treatment Plant Sites

Los Osos Mortuary, Giacomazzi, Branin, Robbins 1, Robbins 2, and Andre Sites. Materials of undifferentiated Paso Robles Formation and/or alluvium were encountered in each of the explorations from our previous investigation (Fugro, 2007) at the sites. The upper 3 to 4 feet of materials appeared to be relatively loose/soft and likely represent topsoil/colluvial materials disturbed during previous agricultural/plowing activities. There appears to be a low potential for liquefaction to impact these sites based on currently available information.

Tonini Site. The lower, generally flat topography of the Tonini site is characterized primarily by alluvium, with queried deposits of dune sand and Paso Robles formation. The slopes along the western and northern portions of the site have been mapped as Franciscan mélange and metavolcanics. During a site visit on May 6, 2008, Fugro noted the presence of alluvial, surficial clayey soils on the generally flat portions of the site, and Franciscan units on the adjacent slopes. As shown on Plate 7, without site-specific geotechnical study the recent alluvial sediments are considered to have moderate to high potential for liquefaction if groundwater elevations are high. However, the presence of fine-grained, cohesive materials within the soil profile suggests a lesser potential for liquefaction and seismic settlement than that typically associated with cohesionless soils. The majority of the Tonini site appears to have relatively shallow soil cover overlying Paso Robles Formation or Franciscan rocks, and although further geotechnical analysis is needed to evaluate liquefaction potential for a treatment facility at this site, a site could likely be selected outside any areas that may be vulnerable to liquefaction.

Mid-Town Site. The site is underlain by a variable thickness of relatively loose to medium dense dune sand deposits that overlie relatively dense sand of the Paso Robles Formation (age-equivalent). During our previous investigation (Fugro, 2004a), the groundwater table was generally encountered within the denser sand and below the base of the dune sand deposits. Grading was recommended to remove the loose soil from improvement areas that may be vulnerable to seismic or static settlement. The denser sand within the Paso Robles Formation is estimated to have a relatively low potential for seismic settlement and liquefaction.

Turri Road Site. The Turri Road site is underlain by alluvium. As shown on Plate 7, without site-specific geotechnical data and given the recent alluvial sediments, low elevation of the site, and the likelihood of shallow groundwater, the site is considered to have a relatively high potential to be impacted by liquefaction. Fugro estimates a high potential for liquefaction and seismic settlement to impact the site.

Mitigation. The building code requires liquefaction and associated mitigation to be addressed in the design-level geotechnical report for design. With the exception of the Turri Road site, the treatment plant sites appear to have a moderate to low potential for liquefaction.

As discussed above, grading would remove loose soil from the Mid-Town site that is considered vulnerable to seismic settlement. A geotechnical study of the Tonini site should allow for a suitable site for the treatment facility to be selected outside areas where mitigation of liquefaction may be required. The Turri Road site should be further evaluated if selected for design; however, there is a relatively high potential that mitigation of liquefaction or seismic settlement would be needed to develop the site for the treatment plant.

The design-level geotechnical report should address liquefaction for the selected wastewater treatment site considering the treatment facility (structure vs. ponds), the storage reservoirs, and related site improvements. Mitigation for liquefaction and seismic settlement typically consists of either removing the soil that is prone to liquefaction and seismic settlement and replacing it with properly compacted (engineered) fill; deeply compacting the soil in-place; or supporting structures on deep foundations bearing below the settlement-prone soil. Deep compaction or deep foundations may be needed to support structures, or portions of the structures, if the estimated seismic settlement cannot be tolerated using shallow or mat foundations. The tolerable settlement and foundation design for the buildings should be further evaluated by the geotechnical professional and structural engineer during the design of the project.

4.3.1.3 Effluent Disposal Sites

Broderson. The proposed effluent disposal system at Broderson will be located on a relatively gently sloping hillside approximately 1,200 feet south of Highland Avenue. Based on previous investigations (Fugro, 2004a), the depth to groundwater is greater than 100 feet below the existing ground surface, and except for the near-surface loose dune sand deposits, the deeper soils encountered beneath the site are generally dense and not susceptible to liquefaction or seismic settlement. The near-surface loose dune sand would be considered potentially liquefiable in the event that they were saturated at the time of an earthquake; however, the groundwater depths will not be permitted to rise near to the ground surface at the site (Cleath and Associates, 2000). Therefore, Fugro (2004a) concluded there is essentially no change in the potential for liquefaction or seismic settlement to occur within the soils encountered as a result of the effluent disposal system and estimated mounding at the Broderson Site.

Tonini. The spray field irrigation at Tonini likely have little impact on the potential for liquefaction. Should liquefaction occur at the site, it is unlikely that the occurrence of liquefaction would impact the suitability of the site for spray irrigation. Clay soil mapped over most of the site likely limit the infiltration of irrigation water. Low lying areas along the southern end of the site, may contain liquefiable soil, but are likely to have an increased potential for liquefaction due to irrigation.

Mitigation. None anticipated.

4.3.2 Lateral Spreads

Lateral spreading is slope instability that can occur in response to liquefaction. Lateral spreading typically develops on sloping ground underlain by liquefiable soils or where free-face conditions can develop in a liquefiable soil, such as along a river bank or drainage. Prospective sites that include rivers banks or descending slopes that may allow for free-face conditions to develop within liquefiable soils, and the potential for lateral spreading to impact the sites during a seismic event are discussed below. As discussed in Section 3.6.1 of this report, lateral spreading was observed in areas along the perimeter of Morro Bay following the December 2003 San Simeon Earthquake. Observed lateral spreading was generally confined to inlets and shoreline areas, and not within the proposed collection system area. Stream bank areas along Los Osos Creek are also likely vulnerable, and could impact the conveyance pipes at creek crossing locations.

Above-ground treatment and storage ponds with earth berm perimeters likely would be susceptible to liquefaction-induced slope instability if founded on potentially liquefiable soil. The potential for berm instability is predominantly governed by the inclination of berm slopes and relative density of the underlying foundation support soil. Only the Turri Road and Tonini sites are likely to have foundation soils that may be prone to liquefaction. Design and construction of slopes should be further evaluated in subsequent design level geotechnical reports.

Mitigation. The design-level geotechnical report should address the potential for lateral spreading to occur in association with liquefaction, and whether or not the hazard could impact the design of the conveyance structures, storage reservoirs or other improvements. The ERP should consider the potential for lateral spreading in association with liquefaction along shoreline areas and creeks. Mitigations, such as lowering the conveyance pipelines below potentially liquefiable soils and the need to remove liquefiable soil from beneath the storage reservoir berm to maintain slope stability, should be addressed in the report.

4.3.3 Ground Lurching

Ground lurching occurs as the ground is accelerated during a seismic event. As evidenced by the Loma Prieta, Landers, Northridge, and San Simeon earthquakes, the effects of ground lurching can damage facilities and buried pipelines. Ground lurching occurs due to detachment of underlying stratigraphic units, allowing near-surface soil to move differentially from underlying soil. The site is within a seismically active region of central California that is prone to moderate to large earthquakes. It is therefore our opinion that there is a potential for ground lurching to impact the site. Ground lurching is generally not a geologic hazard that can be prevented, and therefore is mitigated by implementing preparedness measures.

Mitigation. Address in ERP with other seismic hazards.

4.4 LANDSLIDING

The project sites are generally on relatively flat terrain and not in areas that would be subject to landslides. However, based on review of aerial photographs, site reconnaissance

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Mitigation. The design-level geotechnical report should provide recommendations for foundation design, site preparation and grading to provide suitable support for structures.

4.9 TSUNAMIS AND INUNDATION

Tsunamis, or long-period sea waves created due to seismic events or submarine landslides, have historically occurred in the project region. Tsunamis can range in height from a few feet to greater than 50 feet, and can result in run-ups, or bores, extending great distances up streams, rivers, and creeks. As evidenced by recent events around the world, tsunamis can have devastating impacts on coastal areas. The project vicinity is located at elevations (el) ranging from approximately sea level for the portions of the pipeline that bound Morro Bay to approximately el. +200 feet above mean sea level (MSL) at the Broderson and Tonini sites. The County of San Luis Obispo has prepared web-based tsunami inundation maps (http://www.sloplanning-maps.org/ed.asp?bhcp=1) that show coastal areas that may be vulnerable to inundation from tsunami below about el. +40 feet MSL. The inundation zones are generally the coastal areas along Morro Bay, and low lying areas along Los Osos Creek and the vicinity of Warden Lake. According to Kilbourne and Mualchin (1980), the following historical tsunamis have occurred in the project region:

Historical Tsunami Run-up

Year	Estimated Tsunami Generation Location	Estimated Impact Location	Estimated Tsunami Run-up (meters/feet)
1868[1]	Unknown	Morro Bay	Unknown
1878[2]	Unknown	Morro Bay	Unknown
1927	Local	Pismo Beach	1.8 meters/5.9 feet
1946	Aleutian Trench	San Luis Obispo Bay	1.2 - 1.5 meters/3.9 - 4.9 feet
1960	Chile-Peru Trench	Central Coast	>1.0 meters/>3.3 feet
1964	Gulf of Alaska	Central Coast	>1.0 meters/>3.3 feet

[1] Speculative

[2] Reportedly overtopped the sand spit that separates the bay from the ocean (SLO County 1999).

As noted in the above table, tsunamis generated from far-field sources have historically occurred in the project region. A study performed by Houston and Garcia (1978) estimated the 100-year and 500-year tsunami run-ups in the study area based upon far-field source generation locations (such as the Aleutian or Chile-Peru Trenches). On the basis of their study, the estimated tsunami run-up along the Cayucos/Morro Bay coastline is up to approximately 9.5 feet to 24.2 feet for the 100-year and 500-year events, respectively. Those run-ups were calculated using astronomical high tides, and compare well with recorded tsunamis that have occurred in Crescent City and other locations along the California coast. However, according to Kilbourne and Mualchin, the worst case scenario would occur if a tsunami occurred during a meteorological high tide (storm surge), which would add an estimated 15 feet to the run-up values calculated by Houston and Garcia (1978). Thus, with a worst case scenario, the estimated tsunami run-up for the 100-year and 500-year would be approximately 25 and 40 feet, respectively.

Houston and Garcia's (1978) study did not evaluate the tsunami run-up potential generated from local seismic events or local submarine landslides. It is difficult to model the tsunami run-up magnitudes based on local events; however, it is thought that local events can generate tsunamis of equal magnitudes as far-field tsunami sources (Kilbourne and Mualchin 1980).

The entire Turri Road Site and coastal areas of the collection system are below the estimated tsunami run-up elevations shown on the County website. As a result, tsunami run-ups may be considered a potential hazard to the Turri Road Site as a prospective location for the wastewater treatment plant. However, tsunami run-ups should not result in adverse impacts to the pipeline in areas where it is buried and protected from scour, or impact areas where the pipeline is above the run-up elevations. We would expect that there is a potential that locally the pipeline could be exposed and possibly damaged as a result of erosion associated with tsunami run-up.

Mitigation. None anticipated. Tsunami hazards are typically addressed by developing warning systems and evacuation plans for coastal areas. The San Luis Obispo County Office of Emergency Services is responsible for the emergency response plan.

4.10 NATURALLY OCCURRING ASBESTOS

Naturally occurring asbestos (NOA) is common in serpentine rock throughout San Luis Obispo County. The California Air Resources Board has identified serpentine rock as having the potential to contain asbestos. Serpentine rock is typically a constituent of Franciscan Formation mélange, which is mapped on the slopes along the northern limits of the Tonini site and north of the Turri Road site. Mélange has not been mapped or encountered at any of the remaining prospective sites. We do not anticipate components of the project will be planned for areas potentially containing serpentine rock. Therefore, it is our opinion that there is a low potential for NOA to impact the project.

Mitigation. None anticipated. The County will likely require a letter prepared by a geotechnical professional for project that specifically identifies whether or not NOA is an issue for the project.

5.0 GEOTECHNICAL CONSIDERATIONS AND IMPACTS

The following provides a summary of preliminary geotechnical considerations that are likely to affect the project. These items will need to be considered in the design and construction of the project.

5.1 SEISMIC DATA

San Luis Obispo County has adopted the 2007 California Building Code effective January 1, 2008. Buildings and structures for the new wastewater facility will be designed to the minimum requirements of Seismic Zone 4. The site preparation and foundation design should consider any associated impacts that could be associated with liquefaction, seismic settlement, or ground instability as discussed in this report. Seismic design criteria from the 2007 California Building Code are discussed in section 3.5.2 of this report.

5.2 COLLECTION SYSTEM

5.2.1 Excavation

Excavation for the collection system will generally consist of trenching to allow for placement of the new sewer pipes and service laterals from the existing residences. Improper excavation techniques and can result in instability of the trench sidewalls, unsafe working conditions, and damage to adjacent property, utilities, and streets. As part of the Fugro (1997) field exploration program, 7 backhoe trenches were excavated at the site. On the basis of the trenching, the main geotechnical considerations for the trench excavations will be:

- The soils encountered within the collection system area generally consist of sandy soils. The trenches that were excavated at the site were performed using a rubber-

tire mounted backhoe with a 30-inch-wide bucket. The sand should be able to be excavated for pipeline trenches relatively easily using conventional backhoe or excavator type equipment typically used for pipeline construction.

- The sand encountered in the previous explorations generally has low or no cohesive strength. These materials generally will not stand unsupported in excavations with vertical sides. Depending on the soil moisture conditions at the time of construction, the soil may exhibit apparent cohesion for a time; however, even temporary unsupported excavations with vertical sidewalls should be considered to be potentially unstable and subject to collapse. Excavations should be sloped or shored in accordance with OSHA requirements.

- Groundwater was encountered at relatively shallow depths in the borings, trenches, and CPT soundings. Where groundwater was encountered in our trenches, we observed that the walls of the excavation typically became unstable and collapsed or flowed into the excavations. Excavations extending below the groundwater table should not be considered feasible without the use of dewatering prior to excavation. Areas of potentially high groundwater are shown on Plates 5a and 5b.

- Trenching for the collection system mainly be performed in the existing streets. Placement of the pipe will typically involve saw cutting the existing pavement, removing pavement, excavating the trench, placing the pipe, placing backfill, and patching the street. Stockpile areas adjacent to the trench are typically needed to provide access for pipe delivery, stock piled material excavated from the trench, and provide access for haul trucks delivering and hauling away trench excavation and backfill material. This system can easily occupy the width of the roadway and limit access of most residential streets.

Mitigation. Trench and excavation and shoring is the responsibility of the contractor. Trench walls should be supported in accordance with Cal OSHA requirements, and properly sloped, shored, and dewatered to prevent instability of the trench walls and damage to adjacent property.

5.2.2 Dewatering

Groundwater conditions are notoriously shallow in many areas of the communities of Los Osos, Baywood, and Cuesta-by-the-Sea. Construction dewatering likely be needed to allow for construction of portions of the collection system. Improper construction dewatering can result in instability of trench walls, removal of insitu soil and subsequent subsidence of the ground along the trench, and flooding of the trench preventing proper construction. Groundwater depths based on previous studies within the collection area are summarized on Plates 5a and 5b. In some areas of the site, groundwater daylights on the surface, resulting in areas of ponding, springs, and seeps. Groundwater and surface water conditions along the coastal areas in Baywood and Cuesta-by-the Sea are likely influenced by tidal fluctuations. Groundwater changes will also fluctuate seasonally, and with variations in storm water runoff, irrigation schedules, rainfall, and other factors.

- On the basis of the groundwater conditions previously encountered within the collection area, it is our opinion that dewatering will be needed to construct the pipeline trenches. The contractor should be responsible for selecting the method of dewatering, and for maintaining the dewatering system, as-needed, to allow for the pipeline construction.
- Dewatering should consist of lowering groundwater levels below the bottom of the trench prior to excavation. Dewatering should be performed such that water does not seep through side walls of the trench, and is significantly below the invert of the pipe to allow for stabilization of the subgrade and compaction of the pipe zone bedding material.
- Dewatering facilities, such as sump pits, wells, and well points should be designed with filters such that sand and fine-grained materials are not removed from the soil during dewatering operations. Dewatering facilities should be installed in advance of beginning excavation, and time should be allowed for lowering of the groundwater table before beginning excavation. Prior to mobilizing equipment to the site, the contractor should be required to submit a dewatering plan for review by the design consultant and geotechnical engineer. A qualified registered professional should prepare the dewatering plan.
- Although the majority of soil conditions previously encountered generally consisted of sandy materials, layers of moderately cemented, dense sand and clay were encountered in some of the explorations at depth. It is our experience that these types of conditions can perch groundwater, and subsequently reduce the effectiveness of dewatering wells constructed at depth to drawdown the groundwater table. The contractor should perform field pump tests to evaluate the depth and spacing of dewatering points or wells prior to submitting the dewatering plan.
- Discharge requirements from the Regional Water Quality Control Board will need to be permitted to allow for construction dewatering.

Mitigation. Construction dewatering should be performed by a qualified contractor. Discharge permits and requirements for construction dewatering should be addressed in advance of beginning construction.

5.3 SITE PREPARATION AND GRADING

We anticipate that site preparation and grading will be needed to provide uniform support for building foundations, pavements, concrete flat work, and related structures. The near-surface soil is relatively loose, prone to hydrocollapse, and is not suitable for support of the improvements. Grading typically consists of removing the existing soil to a specific depth below the existing ground surface, and replacing the excavated materials as compacted fill. The specific depth of the removal will depend on the results of design-level geotechnical study, but likely be about 5 feet or less.

Mitigation. The design-level geotechnical report should provide recommendations for foundation design, site preparation and grading to provide suitable support for structures.

5.4 FOUNDATION DESIGN

Foundations should be designed such that structural loads are transferred to the ground without exceeding the allowable bearing capacity of the soil, and such that the settlement of the ground in response to structural loading does not exceed tolerable limits for the structure. The project development is expected to consist of single-story buildings for the plant operation, pump station controls, and generators. Geotechnical considerations that could impact the design of the building foundations are differential settlement associated with liquefaction or seismic settlement, and the presence of potentially compressible soils that may be present below the depth of grading.

We expect that building and tanks associated with the wastewater project likely be supported on shallow foundations bearing in compacted fill. The exception may be the Turri Road site, where there is a potential for soft ground conditions, which may require that building or treatment facilities be supported on deep foundations, such as driven piles. At the remainder of the site, grading will likely be performed to provide uniform support for foundations and structures, and limit the potential for settlement due to the foundation load. Additionally, footings can be tied together with grade beams or designed as a single “mat” foundation to help distribute structural loads, reduce bearing pressures, and help to limit differential settlement.

If structural loads are relatively large, the footing size will need to be increased to accommodate the higher load, and the depth of soil that is influenced by the pressure of the footing will extend to a greater depth. In soft, liquefiable, or compressible soil, it may not be practical to design the grading deep enough to limit the settlement to within tolerable limits for the structure.

Mitigation. The design-level geotechnical report should provide recommendations for foundation design, site preparation, and grading to provide suitable support for structures. The type of foundation systems and tolerable settlement for structures will need to be addressed during the design phase of the project. Additional geotechnical evaluation, and coordination with the structural engineer, will be needed to select the appropriate foundation type and grading needed to support foundations.

5.5 SITE SELECTION FOR TREATMENT PLANT

With the exception of the Turri Road site, the treatment plant sites appear geotechnically feasible for design, have limited potential to being impacted by geologic hazards, and will likely be constructed using relatively conventional foundation support and grading methods. No site-specific geotechnical evaluation has been performed for the Turri Road site. Because the site has potential for shallow groundwater and soft ground, the design and construction of a treatment plant on this site could be geotechnically complex, costly, and prone to being impacted by geologic hazards such as liquefaction, seismic settlement, and inundation from a relatively catastrophic tsunami.

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Mitigation. Further geotechnical evaluation and exploration of the Turri Road site should be performed to further evaluate geologic hazards and geotechnical considerations for the project, if this site is to be selected for design.

6.0 SUMMARY

Hazard/Geotechnical Consideration	Summary	Consideration/Mitigation
Fault Rupture	No known faults appear to impact the current sites.	None
Strong Ground Motion	Project site is likely to be impacted by strong ground motion. Historical earthquakes have impacted the Los Osos Community in the past.	Design and construction should be performed in accordance with minimum requirements of California Building Code (2007), as adopted by County of San Luis Obispo. A Geotechnical Report, prepared by a California registered Geotechnical Engineer and Professional Geologist, should be prepared for the design of the project to provide seismic data for use with the building code.
Seismic-Related Ground Failure (liquefaction and seismic settlement)	Collection System and Conveyance Network: Portions of the collection system and the out-of/in-town conveyance pipelines traverse areas having a high potential for liquefaction. The greatest potential for liquefaction is within areas that are either low in elevation, such as the shoreline areas along Morro Bay and interdunal depressions along Morro Avenue, Paso Robles Avenue, Santa Ynez Avenue, and Ramona Avenue-Mitchell Drive, and along the drainages of Los Osos Creek. These areas are typically characterized as being underlain by relatively loose sand and shallow groundwater.	A Geotechnical Report should be prepared for the project to address liquefaction hazards, and provide recommendations for mitigation. When practical, pipelines should be founded below liquefiable soils. An Emergency Response Plan (ERP) should be prepared as part of the operation and maintenance plan for the wastewater facility. The ERP should recognize the potential for liquefaction and seismic hazards to impact the pipeline, and specific high hazard areas that should be inspected for damage following an earthquake. “Soft fixes” are sometimes incorporated in the ERP. Soft fixes typically consist of having a plan in-place to address the hazards, such as can be achieved by storing supplies and equipment for repair.
	Wastewater Treatment Plant Site: Previous studies suggest that the Los Osos Mortuary, Giacomazzi, Branin, Robbins 1, Robbins 2, Andre and Mid-town Sites have a low potential for being impacted by liquefaction. Additional exploration and geotechnical evaluation would be needed to evaluate the liquefaction hazards at the Tonini and Turri Road site. Based on geologic review, portions of the Tonini site have a moderate potential to be underlain by potentially liquefiable soil. There is a relatively high potential for the Turri Road site to be underlain by potentially liquefiable soil.	A design-level Geotechnical Report should be prepared for the design of the project that addresses liquefaction hazards and any mitigation for the selected site in accordance with building code requirements. A preliminary geotechnical report should be performed in advance of design, if a treatment plant is to be sited at Turri Road or on the Tonini property. The preliminary study should address whether or not the sites being considered will require mitigation for liquefaction, and if they are geotechnically feasible and preferred for this project.
	Effluent Disposal Sites: The soils beneath the Broderson site that may be subject to a rise in groundwater level are generally dense and not prone to liquefaction. The Tonini site will have spray irrigation, is not a facility that would be expected to be significantly impacted by liquefaction hazards, if it were to occur.	None

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Hazard/Geotechnical Consideration	Summary	Consideration/Mitigation
Seismic-Related Ground Failure (lateral spread)	Lateral spreading is slope instability that can occur in response to liquefaction. Lateral spreading is most likely to occur along shoreline areas of inlets and the bay, and not within the proposed collection system area. Stream bank areas along Los Osos Creek are also likely vulnerable to lateral spreading in association with liquefaction, and could impact the conveyance pipes at creek crossing locations. Above-ground treatment and storage ponds with earth berm perimeters likely be susceptible to liquefaction-induced slope instability, if founded on potentially liquefiable soil. Only the Turri Road and Tonini sites are likely to have foundation soils that may be prone to liquefaction.	A design-level Geotechnical Report should be prepared for the design of the project that addresses liquefaction and lateral spreading hazards and any mitigation for the selected site in accordance with building code requirements.
Seismic-Related Ground Failure (ground lurching)	Ground lurching (detachment of near-surface soil layers or strata) can occur in variety of subsurface conditions, is not easily predicted, and cannot be avoided or mitigated.	Operation and emergency response plans should consider the potential for ground lurching to occur in response to seismic events, and the potential for lurching to damage lifelines, utilities, and structures.
Landsliding (building areas)	Generally the improvements are not located on ground mapped as existing landslides or in areas of known slope instability. However, the hills adjacent to the Tonini site and along Turri Road are underlain by Franciscan mélange and show relatively extensive evidence of slope instability, landsliding, and creep.	A California professional geologist (PG) should evaluate the limits of the spray fields during the design of the project to confirm that spray fields are not located in areas of known or potential slope instability, landsliding, or creep. The design plans for the spray fields should be reviewed by the CEG, and the CEG should document the review in writing with any recommendations for modifying the limits of the spray field. The recommendations of the CEG should be incorporated into the design plans.
Subsidence and Collapse	The site is not in an area where extraction of fluids (such as groundwater or oil) is known to have resulted in subsidence or collapse.	Likely, none at existing groundwater levels. If dewatering or lowering of the groundwater level is expected, the associated impacts to the site and grading and foundation design should be addressed in the Geotechnical Report.
Erosion	Graded areas of the site will be prone to erosion.	Erosion control measures should be implemented during grading to minimize the impacts of erosion during grading. Graded cut and fill slopes should be vegetated or landscaped in a manner that will reduce the potential for soil erosion following construction. Site drainage should be provided to control surface water, direct water away from slopes, and control surface water discharge.
Expansive soils	Soils mapped at the Los Osos Mortuary, Giacomazzi, Branin, Robbins 1, Robbins 2, Andre Tonini and Turri Road sites have a moderate to high potential for expansion.	Structures and foundations should be designed according to at least the minimum requirements of the building code. The design-level geotechnical report should address whether or not expansive soil conditions should be considered for design of structures and concrete flatwork, and provide recommendations for mitigating expansive soil conditions.

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Hazard/Geotechnical Consideration	Summary	Consideration/Mitigation
Hydrocollapse	Near surface soils (less than about 5 feet in thickness) are likely to be relatively loose and vulnerable to collapse (hydroconsolidation) when subject to wetting and surface loads.	Soils prone to hydroconsolidation should be removed from building sites during grading, and be replaced with properly compacted fill, or as otherwise recommended in the design-level Geotechnical Report.
Flooding, Tsunamis or Inundation	The County of San Luis Obispo has prepared web-based tsunami inundation maps (http://www.sloplanning-maps.org/ed.asp?bhcp=1) that show coastal areas that may be vulnerable to inundation from tsunami below about el. +40 feet MSL. The inundation zones are generally the coastal areas along Morro Bay, and low lying areas along Los Osos Creek and the vicinity of Warden Lake. The San Luis Obispo County Office of Emergency Services has a program for tsunami hazard warnings and evacuation independent of this project.	None
Trench Excavations	Excavation for the collection system will generally consist of trenching to allow for placement of the new sewer pipes and service laterals from the existing residences. Improper excavation techniques within the dune sand and shallow groundwater areas can result in instability of the trench sidewalls, unsafe working conditions, and damage to adjacent property, utilities, and streets.	Trench and excavation and shoring is the responsibility of the contractor. Trench walls should be supported in accordance with Cal OSHA requirements, and properly sloped, shored, and dewatered to prevent instability of the trench walls and damage to adjacent property.
Dewatering	Groundwater conditions are notoriously shallow in many areas of the communities of Los Osos, Baywood, and Cuesta-by-the-Sea. Construction dewatering likely be needed to allow for construction of portions of the collection system. Improper construction dewatering can result in instability of trench walls, removal of insitu soil and subsequent subsidence of the ground along the trench, and flooding of the trench preventing proper construction.	Construction dewatering should be performed by a qualified contractor. Discharge permits and requirements for construction dewatering should be addressed in advance of beginning construction.
Site Preparation and Grading	Site preparation and grading is needed to provide uniform support for building foundations, pavements, concrete flat work, and related structures. The near-surface soil is relatively loose, prone to hydrocollapse, and is not suitable for support of the improvements. Grading typically consists of removing the existing soil to a specific depth below the existing ground surface, and replacing the excavated materials as compacted fill. The specific depth of the removal will depend on the results of design-level geotechnical study, but will likely be about 5 feet or less.	The design-level geotechnical report should provide recommendations for foundation design, site preparation, and grading to provide suitable support for structures.
Foundation Design	Foundations should be designed such that structural loads are transferred to the ground without exceeding the allowable bearing capacity of the soil, and such that settlement of the ground in response to structural loading does not exceed tolerable limits for the structure. Structures likely be supported on conventional spread footing foundations. The exception may be the Turri Road site, where there is a potential for soft ground conditions, which may require that building or treatment facilities be supported on deep foundations, such as driven piles.	The design-level geotechnical report should provide recommendations for foundation design, site preparation, and grading to provide suitable support for structures.

FINAL Environmental Impact Report

For The

Los Osos Community Services District

WASTEWATER FACILITIES PROJECT

SCH# 9911103

Certified March 1, 2001

Prepared by:

Crawford Multari & Clark ASSOCIATES

Impact BIO-4: **Development of the Tri-W site with a treatment plant will result in the permanent loss of coastal scrub habitat for the Morro shoulderband snail (Class II). Refer to the February 2001 Final EIR page 274.**

Impact BIO-8: **Development of the Tri-W site with a treatment plant will result in the destruction of potential Morro Bay Kangaroo rat habitat. The Morro Bay kangaroo rat is a federally and state listed endangered species. The Morro Bay kangaroo rat has not been seen observed on the Morro Shores or Broderson sites previously. Recent surveys (June 2000) did not find tracks or sign. Dr. Michael O'Farrell has determined that additional surveys using trapping protocol at Morro Shores and Broderson would not be fruitful (Class II). Refer to the February 2001 Final EIR page 275.**

Mitigation of Direct Impacts:

LOCSD's mitigation proposal for the direct impacts associated with development of the wastewater treatment site (Tri-W) is to purchase the single largest remaining privately held undeveloped parcel within the Los Osos greenbelt (Broderson), which totals 80 acres, use 10% of this land for a buried and restored wastewater disposal leachfield, and to donate the entire parcel to a resource agency or organization for long term stewardship and protection.

The direct impacts from the project are the permanent loss of eleven acres at the Tri-W site, eight acres at the Broderson disposal site, and a small amount scattered around the community. The quality of the habitat at each of these sites varies considerably, as well as its viability.

- The Tri-W site is located in the center of the developed area of Los Osos. While it is part of a large block of undeveloped land containing coastal scrub habitat, it has been considerably degraded by veldt grass, erosion and human activities. In addition, most agencies have acknowledged that this land would be developed with urban land uses in accordance with the Estero Area Plan. In fact, the USFWS removed this area from its Draft Recovery Plan.

- The Broderson site is part of the Los Osos greenbelt and contains coastal sage scrub, maritime chaparral, and eucalyptus-dominated windrows. Approximately 40 acres of this site is dominated by Morro manzanita. Approximately eight acres of this site would be used for leachfield and access road. The leachfield should be at least 400 feet behind the homes on the north of the site, but could be placed farther up the hill to the south. **The Broderson site has been relocated farther south and is no longer within the critical habitat area of the snail.**

- The remaining impacts will be the result of installing the collection system and some of the leachfields. By and large these impacts will be to very low quality habitat in the developed portions of the community. For example, collection lines will traverse the fronts of empty lots, some of which have a residuum of habitat, though

severely degraded. These parcels eventually will be developed, mostly with single family homes.

- The Powell property east of the middle school is **no longer proposed** as a leachfield site. The proposal had been to use up to four acres of land. Because of the sensitivity of this site for biological and archaeological resources, and because the site is under agreement for purchase as a conservation property, efforts were made to find a suitable replacement site for the leachfields in this area. The leachfields will be located in a road right of way nearby El Moro Avenue). The Powell property had excellent habitat qualities and is within the critical habitat area of the shoulderband snail.

As mentioned above, the mitigation for the direct impacts of the project listed above is to protect in perpetuity the remaining seventy-plus acres of greenbelt at the Broderson site, **including all of the critical habitat for the snail.**

The LOCSD proposes as mitigation to re-locate the disposal leachfields farther up the hill (to the south) on the Broderson site, within the area dominated by manzanita, which does not appear to support snails. Doing so would eliminate most of the impacts (a roadway up to the leachfields would be required)[1] to the coastal sage scrub which is suitable habitat for the Morro Shoulderband Dune Snail and would be consistent with the USF&WS critical habitat designation. This designation defines critical habitat for the snail as providing the primary biological needs of foraging, sheltering, reproduction, and dispersal. As stated in the designation, *"These areas we are proposing to designate as critical habitat provide these primary constituent elements, which are: sand or sandy soils needed for reproduction; a slope not greater than 10 percent to facilitate movement of individuals; and the presence of native coastal dune scrub vegetation. This vegetation is typically, but not exclusively, represented by mock heather, buckwheat, eriastrum, chamisso lupine, dudleya, and in more inland locations, California sagebrush, coyote brush, and black sage. Some of the habitat in the critical habitat untis could be improved through habitat rehabilitation or improved management (e.g. removal of nonnative species)."* [66 FR 9236] The designation goes on to say that special management considerations for protection of the snail in this unit of critical habitat are not in place. With the development of the wastewater facility, the protection and management of this area is possible.

Under this approach, the eight acres of manzanita removed for construction of the leachfield would be mitigated at a ratio of approximately five-to-one by the permanent preservation of the remaining 75 acres of the Broderson property, 40 acre of which is coastal live oak woodland/manzanita habitat.

[1]The end of Broderson Street turns into an unpaved trail leading south up the hillside. It is currently gullied and provides considerable sediment to the properties down gradient. The leachfields offer an opportunity to develop a controlled access to the LOCSD site and eliminate the drainage problem in the area.

The loss of habitat at the Tri-W site would be mitigated by the thirty-plus acres of undisturbed snail habitat remaining at Broderson (assuming a worst case for the remaining habitat). The Broderson habitat is of considerably higher quality and is part of the designated critical habitat for the endangered Morro shoulderband snail [66 FR 9233]. The district proposes to protect and restore this critical habitat, and donate the land to an appropriate resource conservation agency or organization. Some of the area on Broderson is infested with veldt grass and the district proposes to remove this invasive species. The mitigation ratio for this proposal would be approximately three-to-one.

There is no established ratio for mitigation of habitat loss in this area. No agency or organization has undertaken a study of what appropriate mitigation for loss of habitat would be. The district's proposal, as modified, would not only protect a large area of critical habitat, it would meet or exceed the ratios requested by the Department of Fish and Game.

Note that the area recommended for relocation of the disposal leachfields could be situated at the boundary of the coastal scrub and manzanita. No snails were found by Jones & Stokes Associates during a study of the Broderson site in the area recommended for the leachfields. It was postulated that the slope was too great for there movement. Roth also noted a lack of snails as you moved beyond 300 feet from the north boundary of the site [1997, pers. comm.] Furthermore, the manzanita is relatively sparse here as one habitat transitions into the other. Using this "middle ground" may provide the best protection for the snails and the manzanita.

The final location of the leachfields on Broderson will be refined with the assistance of the resource agencies to maximize the conservation potential of the remaining acreage of the site. The discussion in the EIR is sufficient to allow this flexibility, and no impact will occur that has not been contemplated.

In addition to the land proposed for acquisition to satisfy mitigation, the district is proposing to spend $10,000 per year **(indexed to an inflation multiplier)** in perpetuity for the management of the property, even though it will eventually be owned by a different party. Furthermore, the district has proposed to improve the habitat qualities of the Broderson site by removing exotics and trash within the property.

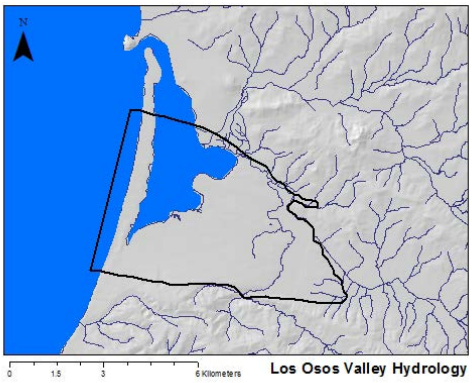
In either event, the LOCSD has committed to purchase 70 plus acres of greenbelt, both as mitigation for direct impacts of the project, and as part of a comprehensive protection strategy for all the important natural resources of the Los Osos greenbelt ecosystem.

Mitigation:

Mitigation BIO-4 Mitigate for Loss of Coastal Scrub Habitat. Agency Consultation/Permitting. Project implementation would result in direct or indirect disturbance or potential take of several federal and state listed species. Project implementation would require authorization for this disturbance or potential take

Central Coast Watershed Studies

CCoWS



Can Los Osos Valley Groundwater Basin Provide a Sustainable Water Supply?

CSUMB Class ENVS 660

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The post-sewerage basin management plan has been the focus of a long political and scientific discussion in the Los Osos Valley. Since the draft EIR was published (January 2009), technical memoranda have been developed as part of the ISJ basin planning process (Cleath-Harris 2009). These provide scenarios the TMs indicate will create a sustainable basin, which recommend pumping more water from the upper aquifer and less from the lower than recommended in the EIR management scenarios. The TMs base the recommendations on updated "safe yields" developed using a dual-density model, rather than the equivalent freshwater head (EFH) models used earlier. TM recommendations are to shift 900 AFY of pumping from the lower aquifer to the upper doubling its current pumping levels (800 AFY to 1670 AFY). The safe yields (pumping levels) in the lower aquifer would be reduced from about 1300 AFY to about 650 AFY (Cleath-Harris, 2009). The EIR and TM scenarios and management strategies raise several concerns related to the uncertainties of hydrologic modeling and adequate project mitigations, which are considered in sections of this report.

1.2 Implications of Groundwater Velocity

1.2.1 Rates and Time

Public discussion and management of groundwater often de-emphasize the timescales involved, as the rates and processes of groundwater movement are not intuitive. Groundwater moves differently from surface water, with hydraulic conductivity of the base material, hydraulic gradient, and pressure being the most important factors controlling water velocity. The range of flow rates are extremely large, with one variable in the equation, conductivity, ranging through five orders of magnitude in just sand and gravel (Ward and Trimble 2004). The ability to pump water from deep wells is very recent, starting in California in 1907 with the multi-stage turbine pump, which allowed pumping from several hundred meters below ground (Narasimhan 2009). Before this technology, centrifugal pumps were limited to 8m depths, and other wells had to be situated over pressurized artesian aquifers, which were often rapidly depleted (Narasimhan 2009). As recharge to aquifers can take many decades and residence times or average age of water in aquifers is often hundreds to thousands of years, the 103-year period of access to these resources is very small, and societies have not yet seen many effects of continuous pumping. In the Los Osos basin (Figs 1 and 2), radiocarbon dating of water returned an average age in Zone C of 870 years, Zone D of 3200 years, and Zone E of 7300 years (Cleath 2005). Due to modern water extraction, the current residence time for the lower aquifer is now estimated at 268 years, compared to thousands of years prior to development (Yates and Williams 2003, Cleath 2005).

Table 5. Rates and times of horizontal travel between selected locations.

From	To	Zone	Distance	Avg. K (ft/d)	Hydraulic Gradient (i)	Porosity (n)	Horizontal Rate (ft/d)	Travel Time (yr)
Bayview Hts.	Willow Ck.	A	4760	20.1	0.06	0.225	5.4	2.4
Downtown	Willow Ck.	A	3130	20.1	0.06	0.225	5.4	1.6
Broderson Site	Downtown	C	5300	19.4	0.006	0.175	0.67	21.8
Bayview Hts.	Downtown	C	4427	19.4	0.009	0.175	1.0	12.2
Los Osos Ck/Los Osos Valley Rd	Downtown	C	6546	19.4	0.009	0.175	1.0	18.0
E. Santa Ysabel Ave.	Baywood Park	D	3917	16	0.009	0.3	0.48	22.4
Mid Bay	Downtown	D	7540	16	0.0013	0.3	0.07	297.9
Los Osos Ck/Los Osos Valley Rd	Downtown	D	6546	16	0.01	0.3	0.5	33.6
Los Osos Ck/Los Osos Valley Rd	Downtown	D	6546	16	0.0046	0.3	0.2	73.1
Broderson Site	Downtown	D	5300	16	0.0009	0.3	0.05	302.5
Bayview Hts.	Downtown	D	4427	16	0.0023	0.3	0.1	98.9
Los Osos Ck/Los Osos Valley Rd	Downtown	E	6546	5.5	0.01	0.3	0.2	97.8

The water table at the Broderson site is on average 180 feet below ground surface (Michael Brandman Assoc. 2008) and located in Zone C, so it would take 93 days for a parcel of water to percolate down to the water table. At the Tonini Ranch sprayfield site groundwater is 7 to 42 feet below the ground (Cleath 2008a) so percolation would take 3.6 to 21 days. The current model uses vertical hydraulic conductivity of 0.002 ft/day for the 50 foot thick AT2 clay aquitard and the assumed vertical gradient is 0.4, with no porosity value available (Cleath 2005). This results in a vertical rate of 0.0008 ft /day and a travel time of 171 years for water moving through the AT2 clay.

3.2.1 Implications of Groundwater Velocity

The primary implications of groundwater movement rates in Los Osos Basin are for efforts to monitor and discern effects of current policy actions. It must be recognized that terms such as recharge, equilibrium, and balance are not immediate, but happen over the long term. On some scales such as the average ages of water in the main aquifers from 870 to 7300 years, there is no feasible way of monitoring the true effects of recent actions so far in the future. However, setting up monitoring on the timescale of movement between and within the aquifers is possible.

According to our groundwater velocity results, the Impacts of changes in water-use practices in Zone A such as LID or recycled water (e.g., in percolation ponds or wetlands) could manifest as changes in Willow Creek hydrology in as few as 2 years (Table 5), or sooner depending on how close measures are to the site. The effects of changing recharge regimes on many parts of Zone C would take much longer, about 20 years (Table 5). If a drought were to reduce recharge from Los Osos Creek, the attendant reduced recharge of the current water table depression below downtown in Zone C might not be realized for 18 years. In Zones D and E the same drought could take more than 100 years to impact water tables (and seawater intrusion), depending on the evolving hydraulic gradients (Table 5). This lag time is important in terms of understanding how nitrate levels in the aquifers may change with the project. The reduction in nitrates from the project will take thirty years in the upper aquifer according to the models and about 268 years in the lower if assumptions about aquitard permeability are correct (Yates and Williams 2003). The effect of current actions designed to reduce nitrate concentrations will not be testable for many years, and nitrate levels will continue to rise in the near term (Yates and Williams 2003).

Vertical percolation rates down to the water table are rapid compared to lateral water movement, except where the flow is impeded by aquitards. This may have implications for management. At the proposed Broderson site, percolation to the water table is estimated to be three months but then travel time to downtown takes twenty years (Table 5), so there will be lag time between current geographically dispersed septic recharge and planned point recharge in the system. The transition period, when the recharge system is equilibrating may be a time of saltwater intrusion in the upper aquifer.

The primary impediment to vertical movement in the Los Osos basin is the AT2 aquitard. The time of 171 years for water to move vertically through the aquitard implies that any post-development recharge moving between the upper and lower aquifers is from well leakage between these zones, or natural holes in the clay layer although studies characterize the aquitard as continuous. The Late Quaternary Los Osos fault zone (Fig. 1) cuts through the layers in the groundwater basin, raising the possibility

that the AT2 aquitard is not a continuous barrier. Further, the "hydraulic parameters of the clay have not been measured directly" (Cleath 2005, pg 8). Testing should be done to resolve this question as the vertical permeability of the aquitard is key to estimating recharge potential and safe yields for the lower aquifer. It is worth noting that conservation and other water management strategies that reduce the pumping from the lower aquifer will have the most direct and immediate benefits on the lower aquifer, as recharge from the surface is very slow and the benefits are uncertain.

The long timelines involved in most groundwater basins, as in the Los Osos basin, pose problems for realistic monitoring programs by public agencies. Over periods of twenty or thirty years, most personnel in public agencies, private consulting firms, and politics will have retired, so the transfer of knowledge crucial to effective program implementation may not occur. Similarly, budgets do not often earmark expenses on those timelines, and the political will to fund monitoring programs requested decades earlier may disappear. The timescales described in this paper, with more detailed analysis by consultants, can be used to provide perspective on the most effective groundwater management solutions.

3.3 Rain and Drought

Precipitation data were acquired from two gages, one located in Morro Bay and one located just east of Los Osos in San Luis Obispo. The Morro Bay gage record (MBFD) ranged from 1959 to 2005 and San Luis Obispo gage (CDEC) record ranged from 1905 to 2007.

We first explored the San Luis Obispo record since it contains more years of data and might reveal longer term regional trends (Fig. 6). This gage is located in the San Luis Obispo Creek river basin at 35.3000°N 120.6670°W at 315ft elevation. These annual precipitation data were plotted to look for trends and cycles in a 102 year time frame.

Plots of decadal running averages of precipitation and standard deviations were made to reveal decadal-scale trends, important for drought assessment (Figs. 7 and 8). The plot of decadal precipitation averages shows that the average rainfall in any given decade can have a fairly large range, from 19 inches to 30 inches, if past trends continue. The decadal scale standard deviation shows a visual correlation with decadal precipitation, revealing that higher decadal average rainfall occurs because of a few unusually high rainfall years, rather than a series of above average years. Of importance is that extreme storms have precipitation rates that exceed infiltration rates, leading to a disproportionate amount of runoff instead of infiltration to the groundwater resource.

3.9 Los Osos Wastewater Project Contingency Plan

3.9.1 Mitigation

A contingency plan for the wastewater project should address three key elements:

- Uncertainty in plan elements
- Essential monitoring that can determine if the basin plan is working
- Mitigation activities that will bring the project back in line with desired goals.

Money should be budgeted to perform the required monitoring, periodic assessment of the monitoring data, and appropriate mitigation activities.

Although each contingency plan is unique to a project and a region, there are common elements that are often included in a ground water contingency plan. An example of the outline of a contingency plan is shown in Figure 22 (Taraszki et al. 1997). The purpose of an LOWWP contingency plan is to describe actions that should be taken to monitor effects from the implementation of the LOWWP, and to determine actions that could be taken to mitigate potential adverse groundwater impacts related to either salt water intrusion or the implementation of the LOWWP (DRC2008-00103). Additionally, the plan should provide the means to respond to contingencies. The stated primary purpose of the Los Osos Wastewater Project is to comply with the CRWQCB's directive to reduce groundwater contamination (primarily of nitrate) caused by ineffective septic treatment systems. The secondary objective is to address current water resource issues in Los Osos and the problem of salt water intrusion into the lower aquifer. Because there is likely to be a time delay between project implementation and its potential impacts to some basin groundwater systems and because management options, such as strategies to supply water to wetlands and respond to seawater intrusion in the upper aquifer, require considerable lead time—it is advisable to take the following actions:

a) Be conservative in mitigation plans and err on the side of doing too much rather than too little to prevent, rather than respond to, impacts such as increased seawater intrusion,
b) Set up monitoring protocols for early detection, and
c) Develop a range of options that provide maximum flexibility (including a full range or water conservation and water re-use options) to respond early to signs of groundwater contamination by salt water or other project/management plan impacts.

Contingency Plan Outline

I. Introduction
   a. Purpose and Objectives
II. Background
   a. Project Description
   b. Regulatory and EIR Framework
   c. Regional Geological and Hydrological Conditions
III. Monitoring Well Network
   a. Rational for needed well network
   b. Review of Wells and Site Selection Process
   c. Well Installation Recommendations
IV. Groundwater Sampling Program and Data Analysis
   a. Sampling Program
   b. Procedures
   c. Data Management and Analysis
   d. Hydrologic Balance Evaluation
V. Remedial Contingency Plan
   a. Priority Zone A
      i. Performance Criteria
      ii. Benchmarks

Figure 22: Example of a contingency plan outline extracted from plans developed by Taraszki et al. 1997 and 2007.

A contingency plan identifies areas where there are significant uncertainties and defines remedial plans for responding to outcomes that might occur. In the case of the LOWWP, the primary uncertainties of this project relate to the performance of the Broderson leachfield, salt water intrusion in the upper aquifer, increased salt water intrusion in the lower aquifer and the environmental impact on wetlands, creeks and environmental resources. A contingency plan should be developed for each of these four arenas (called "Priority Zones" in the outline) as well as any other arenas where there is a substantial risk that might arise due to uncertain outcomes. The purpose of this paper is to recommend that contingency plans are developed for these arenas, so that Los Osos can be well prepared to respond if necessary, to a reasonable range of outcomes. Other objectives are to stress the need for preventative measures and to highlight some of the questions that should be addressed in regard to each of the four arenas where we believe contingency plans should be developed. As the LOWWP contingency plans are further defined and clarified, someone or some group with understanding of the final plans and the required hydrological expertise to develop a contingency plan should be

assigned to develop such a plan. It is also advisable the plan is an integrated plan detailing integrated and coordinated responses to potential impacts, with the appropriate administration and funding spelled out in a basin management program or plan.

3.9.2 Priority Zone 1: The Broderson Leachfield Disposal Capacity

Approximately 1130 AFY (1.4 million m3/yr) of septic effluent that is currently dispersed throughout the Los Osos basin will be reduced in stages. Thus, the water that previously leached into the upper aquifer from these septic systems will be redirected to a treatment plant (Hopkins Groundwater Consultants 2008 EIR p. 30). The Broderson leach fields will discharge 448 AFY (550,000 m3/yr) of treated effluent to a single location if this level can be achieved without developing adverse conditions (Hopkins Groundwater Consultants EIR p. 30). Note that this level of discharge to Broderson leach field is half that assumed by Yates in the 2003 modeling effort, but the previous project used "harvest" wells to keep water from day-lighting downhill (Yates and Williams 2003). The EIR speaks to setting up a monitoring program for the Broderson leach field but does not address the need for a contingency plan in the event that this location cannot achieve the desired level of infiltration without adverse impacts.

Below is a list of questions that might reveal where uncertainties exist:

1) Broderson Site: Can the Broderson site dispose of 448 acre feet per year without adverse impact?
2) Can the site provide the desired recharge benefits to the groundwater (upper and lower aquifers, and to wetlands, etc.)

<u>Monitoring Requirements:</u>

The EIR discusses the use of a series of monitoring wells to ensure there is no liquefaction and that day lighting of water does not occur downhill.

Are these impacts likely to be seasonal or weather dependent and is this accounted for in the monitoring plan?

Are there sufficient monitoring wells.

<u>Benchmarks:</u>

How will current conditions be adequately measure and monitor?

Can performance assessment occur at stages through the timeline of septic system removal so that if adverse impacts are detected, the remainder can be delayed until contingency plans are implemented?

Contingency Measures:

Are there other disposal locations that could supplement the Broderson site if it is unable to handle the load requirements?

What are the best alternative locations and why are these preferred?

Could more recycled water be directed to urban reuse, agricultural reuse, and wetlands to reduce the need to dispose of recycled water at the Broderson site?

How much conservation should be in place prior to project start up to allow reduced pumping of the upper aquifer if Broderson fails to recharge the upper aquifer? (This would be designed to prevent/reduce the need for a response.)

Contingency Decision Making Process and Reporting:

Who will be responsible for developing, approving, implementing, and maintaining plans/program initially and over time?

How will plans be funded initially and over time.?

Who should be informed of the results of the monitoring and assessment?

Who should be involved in decision making regarding the need to resort to a contingency plan?

Figure 23 depicts the beginning draft of a decision tree regarding the Broderson site contingency plan. As the contingency plan is further developed and questions like those outlined above are addressed, this decision tree can be added to, refined, and modified.

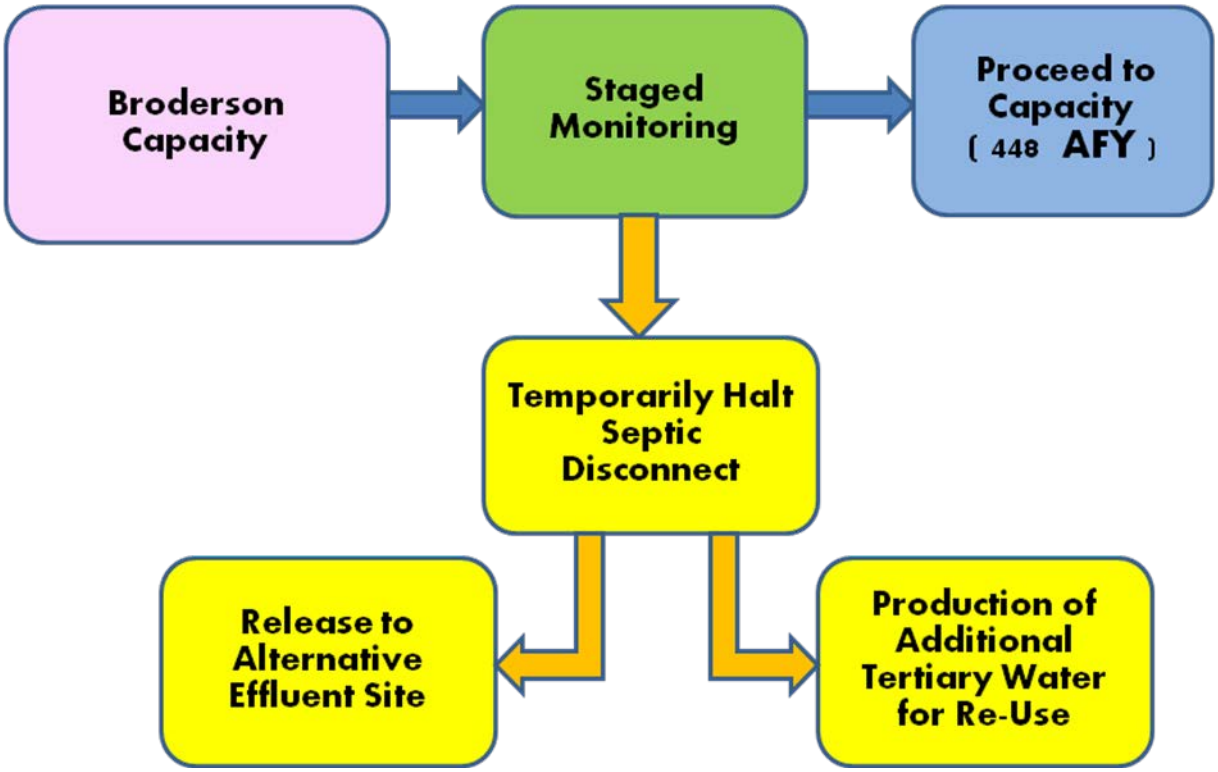

Figure 23:The draft of a decision tree for the contingency plan needed to address the uncertainty of the Broderson site capacity to infiltrate 448 AFY (550,000 m3/yr) without adverse impact.

3.9.3 Priority Zone 2: Capacity of the Upper Aquifer to Resist Salt Water Intrusion

The capacity of the upper aquifer to resist sea water intrusion across the face of the sea water- aquifer interface under the conditions that will exist when the LOWWP is implemented are uncertain. One source of uncertainty is how lateral water flow in the upper aquifer will be impacted when it receives a greater portion of water from a single location (the Broderson site) rather than from dispersed sites (septic systems). It is feasible that a change in flow dynamics could cause more outflow along part of the interface and less outflow along other parts, thereby increasing the possibility of salt water intrusion in reduced flow areas.

Safe yield of the upper aquifer is unknown and is estimated in the Resource Capacity Study to be 1150 AFY (1.4 million m^3/yr) (SLOCDPBD 2007). Current production from the upper aquifer is 800 AFY (985,000 m^3/yr) and safe yield estimates go as high as 1670 AFY (2 million m^3/yr) according to purveyors (Cleath-Harris, 2009). The accuracy

of these yield estimates is uncertain. Under average rainfall conditions, it is currently assumed that the Los Osos upper aquifer discharges approximately 1300 AFY to the bay with a portion of that supplied by septic return flows (based on basin balance charts in the EIR; Cleath & Associates, 2008). The Sea Water Intrusion Assessment states that the upper aquifer is "relatively stable with the potential for onshore sea water intrusion" during extended droughts (Hopkins Groundwater Consultants 2005, p 27). This assessment of the possibility of salt water intrusion was made under current conditions, prior to removing the septic discharge or increasing supply pumping of the aquifer as is proposed by water purveyors. Under the project scenario with only Broderson in the draft EIR the outflow to the bay is estimated to drop by 200 AFY, and with increased pumping from the upper aquifer, outflow will drop by about 200 AFY (from about 1300 to about 1100 AFY) (Brandman Associates, 2009, Cleath-Harris, 2009)

Given the uncertainties associated with Broderson leach fields and project impacts, it is advisable to err on the side of caution by assuming a worse case and providing preventative mitigation programs. The Planning Commission added several conditions to the project to help ensure it would mitigate for potential impacts on seawater mitigation, including Condition 99 which augmented the project's conservation program (SLO Planning Commission, "Findings and Conditions of Approval" August 13, 2009). If the conservation program and other mitigation programs and plans err on the side of caution, they will reduce the possibility of having to resort to a contingency plan. Some of the main project conditions added to mitigate for the project's potential impacts on groundwater include:.

- Condition 97 specifies the need to return treated effluent to the groundwater basin, to use reserved capacity to satisfy environmental and agricultural needs in Los Osos Valley and to avoid using water to satisfy non-agricultural development outside the community.
- Condition 99 outlines a plan for a household conservation effort and specifies a dollar amount of funding to go toward this water conservation program.
- Condition 86 prevents growth until there is evidence for available water to support development without harm to wetlands and habitats.
- Condition 88 agrees the County will assist property owners in the implementation of using existing septic systems for percolating storm water runoff where appropriate.

Even with preventative measures in place, a contingency plan is needed to detect and respond to the possible occurrence of salt water intrusion into the upper aquifer (Fig.

24). If a plan has not yet been developed, a qualified hydrologist should develop a monitoring plan regarding SWI in the upper aquifer, and should include in this plan the needed frequency of monitoring and assessment to make such a determination. A hydrologist should be consulted to determine whether further wells will be required to make this determination. Budgeted money and a contract with the hydrologist for developing a monitoring plan, for needed additional wells and for implementing the monitoring and assessment should be a condition of approval of the LOWWP.

Questions regarding the upper aquifer's Safe Yield and capacity to resist salt water intrusion:

Monitoring Wells:
Is there a sufficient set of monitoring wells to detect salt water intrusion that might result from the LOWWP?
Are additional wells needed as an early indicator so that appropriate response can be taken and responsiveness can be as timely as possible?

Sampling Program:
How frequently should samples be taken at each well?
How should this data be managed and analyzed?
How will the hydrologic balance and current models for this balance be updated and refined based on findings from monitoring?

Contingency Plan:
What are the performance criteria that will be used to evaluate whether the project is having negative impacts on salt water intrusion?
What are the benchmarks that will be used to determine the safe yield of the upper aquifer and to flag the beginning signs of salt water intrusion?
What contingency measures can be taken if there are signs of salt water intrusion into the upper aquifer?
How many AFY can an LID system provide to infiltrate rain water into the upper and/or lower aquifer? How much water can be collected water from hillside runoff, roof tops or impervious surfaces? How many AFY would grey water systems for recharge or outdoor watering save?

Decision Making and Reporting:
Who will pay for the ongoing monitoring and assessment of the condition of the upper aquifer?

4 Recommendations

The challenge of developing a sustainable water supply for the community of Los Osos has been triggered, in part, by development of a waste water project in the area. Planning for the Los Osos Wastewater Project (LOWWP) has included the investigation of several opportunities to avoiding the impacts of the project on the groundwater, and this has highlighted the need to reverse salt water intrusion into the lower aquifers, while protecting the upper drinking water aquifer, and the environmentally sensitive ecosystems in the area that depend on groundwater flows. Community members, water purveyors, San Luis Obispo Public County officials, and other stakeholders, are investigating a range of options to accomplish these water management goals—including shifting pumping locations, intensive conservation, rainwater harvesting and LID strategies, and beneficial reuse of recycled water once the wastewater project goes on line. We recommend that a management plan for the basin, maximize cost-effective water sources (conservation, LID, and recycled water) developed concurrently with the LOWWP, also that the plan err on the said of caution to prevent, rather than respond, to problems, stop or reverse seawater intrusion as soon as possible, and establish a sustainable basin.

Pursuing outside sources of water or a desalination facility to achieve a balanced water budget should be considered last resorts, as these alternatives are expensive, have questionable sustainability, and may bring unintended consequences. For example, desalination facilities are energy intensive and create environmental problems that are difficult to mitigate (Cooley et at. 2006).

4.1 Recommended Actions

For each topic of study, we recommended potential actions that could be taken by the Los Osos community, water purveyors, the County and other governing agencies, with input from the public as plans are developed. We hope that the suggestions will spark creative ideas amongst those who read and discuss them, and stimulate further investigation of possible means for creating a balanced hydrologic budget in the Los Osos basin. The goal of achieving a water balance is an important one, and we credit the community for seeking alternative strategies and outside perspectives toward achieving this goal.

4.2 Pursue a Balanced Hydrological Budget, Monitor to Improve Basin Understanding, and Update Models

Water in deep aquifers has been called “fossil water” because it is ancient water that has slowly accumulated over several millennia and is replenished by gradual processes that occur on a geological timescale rather than a human timescale. The reservoir of fossil water for Los Osos is stored in the lower aquifers and has been depleted at accelerated rates far exceeding the recharge rate. This practice must be stopped for a sustainable

water supply. It is anticipated that water use will transition to the upper aquifer as a primary source; however increased pumping from the upper aquifer may be limited by nitrate contamination, and may have adverse impacts on the upper aquifer, reported to be only "relatively" stable and subject to seawater intrusion during extended droughts (Cleath & Associates, 2005). Due to the many factors and unknowns associated with groundwater hydrology and achieving a balanced Los Osos water basin, we recommend project mitigation measures that err on the side of caution. We also recommend well-thought-out adaptive management strategies and contingency plans that take into account the time scales involved in groundwater movement and the need to act now to head off problems in the future. To successfully balance the Los Osos Valley Water Basin and maintain the water independence of the Los Osos community, we also recommend maximizing use of sustainable options for augmenting the water supply—water-use efficiency strategies, agricultural and urban reuse strategies, and LID recharge.

4.3 Rainwater Harvesting from Roof Top Collection

Rainwater harvesting and LID strategies represent a potential water source which can reduce outdoor water use and help recharge the aquifers supporting basin balance. While our calculation and analysis of the amount of water that can be collected from roof-tops deals with only one factor associated with this potential water source—and our findings were inclusive—the investigation suggests very significant volumes of water may be available from this source to help balance the basin. We recommend further analysis and consideration of t rainwater harvesting/LID options to help balance the basin and mitigate for the project. The option also has several co-benefits, including prevention of stormwater pollution and creation of attractive community features and on-site landscaping features.

4.4 Wetlands as an Alternative for Nitrate Reduction, Water Purification, Tourism, and Ecosystem Values

Wetlands are a relatively inexpensive means for water purification when compared with mechanical treatment systems because they are powered by the natural energies of sunlight, wind and bio-geological interactions (Kadlec and Knight 1996). The relative disadvantage of wetland treatment systems is that they require more land than some other treatment options; However wetlands can be integrated into a community plan that achieves other community goals. Wetlands can become parks, centers for education, and a draw for tourism into an area. They provide quality of life benefits and ecotourism opportunities by attracting wildlife, providing beautiful open space, and creating sites for outdoor recreation and enjoyment.

Assembly Bill No. 2701

CHAPTER 360

An act to amend Section 61105 of, and to add Section 25825.5 to, the Government Code, relating to San Luis Obispo County.

[Approved by Governor September 20, 2006. Filed with Secretary of State September 20, 2006.]

LEGISLATIVE COUNSEL'S DIGEST

AB 2701, Blakeslee. San Luis Obispo County.

(1) Existing law authorizes the establishment of community services districts for the provision of various services to the geographic area within a district, including the collection, treatment, or disposal of sewage, wastewater, recycled water, and stormwater.

This bill would authorize the County of San Luis Obispo to undertake any efforts necessary to construct and operate a wastewater collection and treatment system to meet the needs of the Los Osos Community Services District, as specified, and to impose and collect user fees and other charges to cover the reasonable costs of any wastewater collection or treatment services provided pursuant to these provisions.

The bill would also require the Board of Supervisors of San Luis Obispo County to prepare and submit a proposed assessment to pay for the facilities, and, if certain requirements are met, to decide whether to proceed with construction of the project. The district would retain the powers to provide all other services to a designated zone. After a minimum of 3 years and when the district and the county mutually apply for, and are granted, a modification to the waste discharge permit issued by the Regional Water Quality Control Board, responsibilities would be transferred back to the district.

The people of the State of California do enact as follows:

SECTION 1. Section 25825.5 is added to the Government Code, to read:

25825.5. (a) The Legislature finds and declares all of the following:

(1) There are ongoing discharges to the Los Osos Discharge Prohibition Zone established in the Water Quality Control Plan for the Central Coast Basin.

(2) The agency responsible for eliminating these discharges is the Los Osos Community Services District, which is a relatively new agency, formed in 1998.

(3) The Central Coast Regional Water Quality Control Board has imposed substantial fines on the Los Osos Community Services District for failing to make adequate progress toward eliminating these discharges.

(4) The Los Osos Community Services District has a relatively small staff that has no experience of successfully designing and constructing facilities of the size and type needed to eliminate these discharges.

(5) The County of San Luis Obispo has a larger staff that has experience in successfully designing large public works projects.

(6) There is an urgent need to protect the public health and safety by eliminating these discharges and the most feasible alternative is best accomplished by a temporary realignment of certain wastewater collection and treatment powers between the Los Osos Community Services District and the County of San Luis Obispo.

(7) It is the intent of the Legislature in enacting this section and amending Section 61105 to authorize the County of San Luis Obispo to design, construct, and operate a wastewater collection and treatment project that will eliminate these discharges, particularly in the prohibition zone, to avoid a wasteful duplication of effort and funds, and to temporarily prohibit the Los Osos Community Services District from exercising those powers.

(b) As used in this section, the following definitions apply:

(1) "Board" means the Board of Supervisors of the County of San Luis Obispo.

(2) "County" means the County of San Luis Obispo.

(3) "District" means the Los Osos Community Services District, formed pursuant to the Community Services District Law, Division 3 (commencing with Section 61000) of Title 3, located in San Luis Obispo County.

(4) "Prohibition zone" means that territory within the Baywood Park-Los Osos area of the county that is subject to the wastewater discharge prohibition imposed by the Central Coast Regional Water Quality Control Board pursuant to Resolution 83-13.

(c) The county may undertake any efforts necessary to construct and operate a community wastewater collection and treatment system to meet the wastewater collection and treatment needs within the district. These efforts may include programs and projects for recharging aquifers, preventing saltwater intrusion, and managing groundwater resources to the extent that they are related to the construction and operation of the community wastewater collection and treatment system. These efforts shall include any services that the county deems necessary, including, but not be limited to, any planning, design, engineering, financial analysis, pursuit of grants to mitigate affordability issues, administrative support, project management, and environmental review and compliance services. The county shall not exercise any powers authorized by this section outside the district.

(d) Nothing in this section shall affect the district's power to do any of the following:

(1) Operate wastewater collection and treatment facilities within the district that the district was operating on January 1, 2006.

(2) Provide facilities and services, other than wastewater collection and treatment.

(e) To finance the construction and operation of a wastewater collection and treatment system, the county may levy benefit assessments consistent with the requirements of Article XIII D of the California Constitution, pursuant to any of the following:

(1) The Improvement Act of 1911 (Division 7 (commencing with Section 5000) of the Streets and Highways Code).

(2) The Improvement Bond Act of 1915 (Division 10 (commencing with Section 8500) of the Streets and Highways Code).

(3) The Municipal Improvement Act of 1913 (Division 12 (commencing with Section 10000) of the Streets and Highways Code).

(f) The county may charge standby charges for sewer services, consistent with the requirements of Article XIII D of the California Constitution, pursuant to the Uniform Standby Charge Procedures Act (Chapter 12.4 (commencing with Section 54984) of Part 1 of Division 2 of Title 5).

(g) The county may impose and collect user fees and charges and any other sources of revenue permitted by law sufficient to cover the reasonable costs of any wastewater collection or treatment services provided pursuant to this section.

(h) Promptly upon the adoption of a resolution by the board requesting this action, the board of directors of the district shall convey to the county any requested retained rights-of-way, licenses, funds, and permits previously acquired by the district in connection with construction projects for which the district awarded contracts in 2005. The county shall use those fee interests, rights-of-way, licenses, and funds for the purpose of furthering the construction and operation of a wastewater collection and treatment system pursuant to this section.

(i) After the approval of a benefit assessment, the board shall complete a due diligence review before deciding to proceed with the construction and operation of a wastewater collection and treatment system. The board shall consider any relevant factors, including, but not limited to, the prompt availability of reasonable and sufficient financing, the status of enforcement actions, the successful development of reasonable project technology and location options, the availability of any necessary permits and other approvals, and the absence of other significant impediments. At the completion of this due diligence review, the board shall adopt a resolution declaring its intention to proceed or not proceed with the construction and operation of the wastewater collection and treatment system.

(j) Collection of assessments may not commence until the adoption of the resolution to proceed pursuant to subdivision (i).

(k) The county shall have no power or responsibility to construct and operate a wastewater collection and treatment system pursuant to this

section and the district shall resume that power and responsibility when any of the following occurs:

(1) If the board adopts a resolution not to hold a benefit assessment election pursuant to subdivision (e).

(2) If there is a majority protest to a benefit assessment proposed by the county, on the date of the resolution adopted by the board determining that the majority protest exists.

(3) If there is not a majority protest, but the board adopts a resolution, pursuant to subdivision (i), which declares that the county will no longer exercise its powers pursuant to this section, on the date specified in the board's resolution.

(4) If the county constructs and operates a wastewater collection and treatment system pursuant to this section, not less than three years after the operation of the system commences, the board and the board of directors of the district shall mutually apply to the Central Coast Regional Water Quality Control Board for a modification of the waste discharge permit, requesting permission to transfer of the responsibility to operate the wastewater collection and treatment system from the county to the district. Consistent with that modification, the board shall adopt a resolution that specifies the date on which the county will no longer exercise its powers pursuant to this section.

(*l*) When the power and responsibility to construct and operate a wastewater collection and treatment system transfers from the county to the district pursuant to subdivision (k), the county shall do all of the following:

(1) Promptly convey to the district any remaining retained fee interests in any real property, rights-of-way, licenses, other interests in real property, funds, and other personal property that the county previously acquired pursuant to subdivision (h).

(2) Promptly convey to the district the wastewater collection and treatment system that the county constructed pursuant to this section.

(3) Continue to collect any necessary assessments and use them to repay any indebtedness incurred by the county to finance the construction of the wastewater collection and treatment system pursuant to this section.

(4) The county shall cease collecting any benefit assessments after repayment of any indebtedness incurred by the county to finance the construction of the wastewater collection and treatment system.

(m) Nothing in this section shall be construed as imposing upon the county any liability for any district decisions or actions, or failures to act, or imposing upon the county any liability for any decisions or actions, or failures to act, by any district officers, employees, or agents. In addition, nothing in this section shall be construed as imposing upon the county any liability for any prior or subsequent district liabilities, whether liquidated or contingent, or any prior or subsequent liabilities of district officers, employees, or agents, whether liquidated or contingent.

SEC. 2. Section 61105 of the Government Code is amended to read:

61105. (a) The Legislature finds and declares that the unique circumstances that exist in certain communities justify the enactment of special statutes for specific districts. In enacting this section, the Legislature intends to provide specific districts with special statutory powers to provide special services and facilities that are not available to other districts.

(b) (1) The Los Osos Community Services District may borrow money from public or private lenders and loan those funds to property owners within the district to pay for the costs of decommissioning septic systems and constructing lateral connections on private property to facilitate the connection of those properties to the district's wastewater treatment system. The district shall lend money for this purpose at rates not to exceed its cost of borrowing and the district's cost of making the loans. The district may require that the borrower pay the district's reasonable attorney's fees and administrative costs in the event that the district is required to take legal action to enforce the provisions of the contract or note securing the loan. The district may elect to have the debt payments or any delinquency collected on the tax roll pursuant to Section 61116. To secure the loan as a lien on real property, the district shall follow the procedures for the creation of special tax liens in Section 53328.3 of this code and Section 3114.5 of the Streets and Highways Code.

(2) (A) Except as otherwise provided in this paragraph, on and after January 1, 2007, the Los Osos Community Services District shall not undertake any efforts to design, construct, and operate a community wastewater collection and treatment system within, or for the benefit of, the district. The district shall resume those powers on the date specified in any resolution adopted pursuant to subdivision (j) of Section 25825.5.

(B) Nothing in this paragraph shall affect the district's power to do any of the following:

(i) Operate wastewater collection and treatment facilities within the district that the district was operating on January 1, 2006.

(ii) Provide facilities and services in the territory that is within the district, but outside the prohibition zone.

(iii) Provide facilities and services, other than wastewater collection and treatment, within the prohibition zone.

(C) Promptly upon the adoption of a resolution by the Board of Supervisors of the County of San Luis Obispo requesting this action pursuant to subdivision (h) of Section 25825.5, the district shall convey to the County of San Luis Obispo all retained rights-of-way, licenses, other interests in real property, funds, and other personal property previously acquired by the district in connection with construction projects for which the district awarded contracts in 2005.

(c) The Heritage Ranch Community Services District may acquire, construct, improve, maintain, and operate petroleum storage tanks and related facilities for its own use, and sell those petroleum products to the district's property owners, residents, and visitors. The authority granted by this subdivision shall expire when a private person or entity is ready,

willing, and able to acquire, construct, improve, maintain, and operate petroleum storage tanks and related facilities, and sell those petroleum products to the district and its property owners, residents, and visitors. At that time, the district shall either (1) diligently transfer its title, ownership, maintenance, control, and operation of those petroleum tanks and related facilities at a fair market value to that private person or entity, or (2) lease the operation of those petroleum tanks and related facilities at a fair market value to that private person or entity.

(d) The Wallace Community Services District may acquire, own, maintain, control, or operate the underground gas distribution pipeline system located and to be located within Wallace Lake Estates for the purpose of allowing a privately owned provider of liquefied petroleum gas to use the underground gas distribution system pursuant to a mutual agreement between the private provider and the district or the district's predecessor in interest. The district shall require and receive payment from the private provider for the use of that system. The authority granted by this subdivision shall expire when the Pacific Gas and Electric Company is ready, willing, and able to provide natural gas service to the residents of Wallace Lake Estates. At that time, the district shall diligently transfer its title, ownership, maintenance, control, and operation of the system to the Pacific Gas and Electric Company.

(e) The Cameron Park Community Services District, the El Dorado Hills Community Services District, the Golden Hills Community Services District, the Mountain House Community Services District, the Rancho Murieta Community Services District, the Salton Community Services District, the Stallion Springs Community Services District, and the Tenaja Meadows Community Services District, which enforced covenants, conditions, and restrictions prior to January 1, 2006, pursuant to the former Section 61601.7 and former Section 61601.10, may continue to exercise the powers set forth in the former Section 61601.7 and the former Section 61601.10.

(f) The Bear Valley Community Services District, the Bell Canyon Community Services District, the Cameron Estates Community Services District, the Lake Sherwood Community Services District, the Saddle Creek Community Services District, and the Wallace Community Services District may, for roads owned by the district and that are not formally dedicated to or kept open for use by the public for the purpose of vehicular travel, by ordinance, limit access to and the use of those roads to the landowners and residents of that district.

(g) Notwithstanding any other provision of law, the transfer of the assets of the Stonehouse Mutual Water Company, including its lands, easements, rights, and obligations to act as sole agent of the stockholders in exercising the riparian rights of the stockholders, and rights relating to the ownership, operation, and maintenance of those facilities serving the customers of the company, to the Hidden Valley Community Services District is not a transfer subject to taxes imposed by Part 11 (commencing with Section 23001) of Division 2 of the Revenue and Taxation Code.

(h) The El Dorado Hills Community Services District and the Rancho Murieta Community Services District may each acquire, construct, improve, maintain, and operate television receiving, translating, or distribution facilities, provide television and television-related services to the district and its residents, or authorize the construction and operation of a cable television system to serve the district and its residents by franchise or license. In authorizing the construction and operation of a cable television system by franchise or license, the district shall have the same powers as a city or a county under Section 53066.

(i) The Mountain House Community Services District may provide facilities for television and telecommunications systems, including the installation of wires, cables, conduits, fiber optic lines, terminal panels, service space, and appurtenances required to provide television, telecommunication, and data transfer services to the district and its residents, and provide facilities for a cable television system, including the installation of wires, cables, conduits, and appurtenances to service the district and its residents by franchise or license, except that the district may not provide or install any facilities pursuant to this subdivision unless one or more cable franchises or licenses have been awarded under Section 53066 and the franchised or licensed cable television and telecommunications services providers are permitted equal access to the utility trenches, conduits, service spaces, easements, utility poles, and rights-of-way in the district necessary to construct their facilities concurrently with the construction of the district's facilities. The district shall not have the authority to operate television, cable, or telecommunications systems. The district shall have the same powers as a city or county under Section 53066 in granting a franchise or license for the operation of a cable television system.

SEC. 3. Due to the unique circumstances concerning the wastewater treatment needs in the Los Osos Community Services District, as set forth in Section 1 of this act, it is necessary that, and the Legislature finds and declares that, a general statute cannot be made applicable within the meaning of Section 16 of Article IV of the California Constitution.

O

San Luis Obispo County
Los Osos Wastewater Project Development

VIABLE PROJECT ALTERNATIVES

FINE SCREENING ANALYSIS

FINAL
August 2007

carollo
Engineers...Working Wonders With Water™

In association with Crawford Multari & Clark ASSOCIATES

Cleath & Associates
Engineering Geology/Hydrogeology

The environmental and economic consequences of energy consumption will be given special consideration to develop projects where they are minimized. In Addition, options for individual homeowners to help mitigate the environmental and economic impact of the wastewater project include gray water systems, rain water catchment in existing septic tanks, water conserving landscape, and solar power to offset additional energy consumption.

1.3 FLOW PROJECTIONS

Estimates of the projected wastewater flows and loads were outlined in the Rough Screening Report. The load estimates have not changed, but the flows estimates have been further reviewed in this report due to increased estimates of Inflow/Infiltration. The estimate for the dry weather flow at buildout without conservation remains at 1.2 MGD.

Inflow/infiltration (I/I) estimates for the collection system alternatives were the main source of uncertainty in calculating the future treatment facility influent flow volume. If a STEP/STEG collection system is selected it is anticipated that there will be minimal I/I since the system is sealed and under pressure. If a gravity collection system is selected, only a system that was constructed of fusion-welded PVC piping could be operated with as little I/I as a STEP/STEG system. However, fusion welded PVC sewers are a new technology with little long-term operating history, and can be significantly more costly to install than traditional bell-and-spigot gravity sewers.

Properly installed bell-and-spigot sewers will be watertight at first, and then slowly lose their integrity as the surrounding soils shift, compressing the pipes, and compromising their seals at the joints. The water-tightness of a bell-and-spigot sewer can be preserved if a maintenance program is conducted on an ongoing basis to detect and repair leaks. This program would add to the cost of a gravity sewer compared to a STEP/STEG sewer with similar levels of I/I.

As discussed in the Rough Screening Report, previous studies used standard collection system textbook models[1] to estimate the I/I per mile per inch diameter of pipe of gravity sewer. The total predicted I/I of the system was divided by the estimated population in order to calculate the projected I/I per capita. During wet weather, a conservative estimate for a conventional system I/I of 17 gpcd was given, which corresponded to a total potential wet weather flow of 1.5 MGD for Los Osos. However, it was pointed out that the true value would probably be much lower due to the sandy soils in the region that tend to direct water past a pipe and trench, and due to the presumed water-tightness of a new collection system. Using the textbook models, Montgomery Watson Americas, Inc., anticipated that

* Note: The proposed gravity collection system is supposed to be chemically sealed in high ground water areas. This will reduce I/I. However, the system will still be over 80% conventional gravity subject to high volumes of I/I during wet weather (also exfiltration - leaks out of the system).

[1] From *Wastewater Engineering, Collection and Pumping of Wastewater*, Metcalf and Eddy (1981) and *Gravity Sanitary Sewer Design and Construction*, American Society of Civil Engineers (1982).

7 gpcd would be a more realistic estimate of wet weather I/I, corresponding to a total wet weather flow of 1.3 MGD for Los Osos.

Table 1.2 shows a range of infiltration factors developed for various manufacturing references and textbooks. The gravity sewer infiltration allowance used in this Fine Screening Report is greater than most of the rates suggested in these other references, and is therefore a conservative assumption.

Table 1.2 Gravity Sewer Infiltration References
Los Osos Wastewater Project Development
San Luis Obispo County

Source	Recommendation	Corresponding Infiltration for Los Osos
"Recommended Standards for Wastewater Facilities," Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers, 1997.	200 gpd/in-mi	77,000 gpd
"Installation Guide for PVC Sewer Pipe" PWPipe, March 2000.	50 gpd/in-mi	19,000 gpd
"Gravity Sanitary Sewer Design and Construction," American Society of Civil Engineers, 1982.	500 gpd/in-mi	190,000 gpd
"Wastewater Engineering; Collection and Pumping of Wastewater," Metcalf & Eddy, 1981.	530 gpd/acre(3)	318,000
"Civil Engineering Reference Manual", Michael R. Lindeburg, 2001.	200 gpd/in-mi or 10% of average flow	77,000 gpd or 120,000 gpd
Unibell - http://www.uni-bell.org/pubs/sample_sanitary_spec.pdf	<25 gpd/in-mi	<9,600 gpd
Infiltration Allowance for Viable Project Alternatives in Fine Screening Report (Gravity)		300,000 gpd

Notes:

1. Total of sewer = 254,000 linear feet; 8 in diameter.
2. Predominant value reported - many communities had much less.
3. Los Osos service area = 595 acres

In the Rough Screening Report, 1.3 MGD was identified as the likely wet weather flow for both STEP/STEG and gravity collection systems. However, it was recognized that because of the difference in a pressure tight joint system utilized for STEP/STEG, versus a gasketed bell and spigot joint system utilized for gravity collection system, that there is a higher potential for a gravity system to experience I/I flows over time than there is for a STEP/STEG system. As a result, the wet weather flow for the gravity collection system option was recalculated to be 1.5 MGD (at buildout). This was based on collection system textbook models and was consistent with the calculations previously used by previous studies prior to providing a reduction factor to account for the sandy soils of the area. *

The 1.5 MGD does not take into consideration conservation, however, which is a stated goal of the community for the project. With conservation practices, (i.e. toilet retrofit program and water efficient appliances in all new construction) it is estimated that the total flow can be decreased by at least 0.1 MGD. As a result, a likely scenario to anticipate would be that a portion of the increase in I/I flows for the gravity collection system would be offset by the implementation of conservation practices. Therefore, the wet weather flow used to size the wastewater treatment plant for the gravity collection system was 1.4 MGD (1.5 MGD wet weather flow with I/I minus 0.1 MGD of conservation). For sizing of wastewater treatment plant for the STEP/STEG system the reduction in flow due to the implementation of conservation would similarly apply. The wet weather flow used to size the wastewater treatment plant for the STEP/STEG collection was 1.2 MGD (1.3 MGD wet weather flow with minimal I/I, minus 0.1 MGD from conservation). Gravity * STEP *

1.4 BASIS FOR SCREENING OF ALTERNATIVES

Each of the component alternatives that passed through rough screening was investigated in greater detail for this Fine Screening Report. Cost is an additional element that will be used for screening in this report that was absent in the Rough Screening Report. Conceptual-level cost estimates have been prepared for the component alternatives to enable their comparison. The interdependency of the components (Figure 1.3) will also be used to examine and screen the component alternatives to a greater extent than was done in the Rough Screening Report. Seawater intrusion mitigation will also be considered, since as discussed in earlier, any project that worsens the current groundwater basin condition will be screened out of consideration. All viable projects were developed so they did not worsen the existing seawater intrusion problem.

Following the development of viable project alternatives, the County's project selection process will include a community-wide survey, workshops, and other community participation efforts so that final project decisions meet the needs and desires of the community to the greatest extent possible. In accordance with State and Federal laws, those additional work efforts and final project selection decisions will be completed concurrently with the environmental review efforts.

* Note: Although the proposed collection system will have some parts sealed, the CDP still assumes 300,000 gpd for I/I.

Table 2.3 Reuse/Disposal Considerations
Los Osos Wastewater Development Project
San Luis Obispo County

Disposal/Reuse Alternatives	Disposal Capacity (AFY) For Fully Developed Alternative[1]	Seawater Intrusion Mitigation Factor	Total Seawater Intrusion Mitigation (AFY)	Denitrification Likely Required (AFY)	Tertiary Treatment Likely Required (AFY)	Requires Purveyors' Participation
Spray Fields	1,190	0	0	No	No	No
Cemetery Reuse (in lieu)	50	0.1	5	Partial[2]	Yes	No
Urban Reuse (in lieu, large sites)	63	0.55	35	Partial[2]	Yes	Yes
Agricultural Reuse (in lieu)	460	0.1	46	Partial[2]	Yes	No
Agricultural Exchange	460	0.55	250	Partial[2]	Yes	Yes
Leachfields/Percolation Ponds without Harvest Wells (Broderson site)	448	0.22	100	Yes	No	No
Leachfields/Percolation Ponds with Harvest Wells (Broderson site)	896	<0.22[3]	<200[3]	Yes	No Not accurate.	Yes
Other Actions Influencing Seawater Intrusion Mitigation[4]						
Conservation[5]	160 (at buildout)	0.55	90			No
Harvest Water Exchange[6]	none	0.55	Up to 550[7]			Yes

Much more is needed and possible

Notes:
(1) The project is estimated to require a total disposal capacity of 960 AFY at current conditions and 1350 AFY at buildout, which can be reduced to 1,190 AFY with conservation.
(2) The NWRI report (2006) stated that effluent disposed by land application (i.e., spray irrigation) will not need to undergo nitrogen removal when applied at agronomic rates. However, application of high concentrations of nitrogen would exceed agronomic rates, so partial denitrification to between 10 and 20 mg/L N may be necessary.
(3) Harvesting water to prevent mounding when Broderson is used in excess of 448 AFY reduces the volume of water that percolates to the lower aquifer.
(4) These Other Actions are not reuse/disposal alternatives and therefore do not have an associated capacity.
(5) Conservation is assumed to be achieved through a toilet retrofit program financed by the wastewater project. Although it is not a disposal alternative, it provides an equivalent benefit to 160 AFY disposal capacity.
(6) Does not address wastewater disposal (capacity) and is therefore considered beyond the scope of the wastewater project.
(7) The total mitigation value of harvest water, urban reuse, agricultural exchange, conservation and any other activity that reduced production from the lower aquifer cannot exceed 550 AFY, which is the expected rate of seawater intrusion once septic flows are moved out of town.

Draft
Recycled Water Management Plan
For the
Los Osos Wastewater Project

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Prepared for:

CALIFORNIA COASTAL COMMISSION

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The following sections provide a summary of the critical elements of each of the programs.

1.3.1 Recycled Water Reuse Program

The purpose of the Recycled Water Reuse Program is to identify the quantity of recycled water available at start-up and at build out. In addition, the Program will outline the intended uses that will provide the groundwater basin with the highest level of benefit and the various regulations pertaining to proper treatment and reuse of recycled water.

The Los Osos Wastewater Project

The County will design, construct, finance, own and operate a centralized wastewater collection system and treatment plant to serve those areas of Los Osos located within the LOWWP Service Area. Based on current water production records from the three water purveyors, current indoor water use within the Service Area is approximately 1.1 mgd. With water conservation prior to startup of the wastewater treatment plant, the indoor water use will drop to an estimated 0.7 mgd. Based on the Water Conservation Program that will be pursued by the County and the Water Purveyors, the average indoor water consumption within the Service Area will be reduced to less than 50 gallons per capita per day. At build out, the indoor water use within the Service Area is estimated to be less than 1.0 mgd.

Disposal and Reuse Sites

A portion of the treated effluent will be percolated to the Basin via leach fields to be installed on the Broderson site, thus providing a beneficial water supply to the groundwater basin. The Broderson site is a 80-acre parcel located south of Highland Drive in Los Osos. The leach fields will be constructed on approximately 8 acres of the site; the remainder of the site would be placed in permanent open space and added to the greenbelt surrounding the Los Osos Community. Up to 448 acre feet per year (AFY) of effluent will be discharged at Broderson's 8-acre leach fields. Discharge can occur during wet and dry weather.

The County will utilize the existing Bayridge Estates leach fields, which will no longer be needed as leach fields once the LOWWP is on-line, to percolate approximately 33 AFY of treated effluent. This site provides additional disposal capacity and also mitigates potential impacts to Willow Creek.

The primary objective for recycled water use is to mitigate sea water intrusion by offsetting current pumping and production from the groundwater basin. Therefore, the County's highest priority for delivery is to provide recycled water that will offset current production within the urban area over the groundwater basin.

The largest consumers of water for the Water Purveyors are the schools. There are four schools within the LOCSD and GSWC service areas and none in the S&T service area. The schools include: Los Osos Middle School, Monarch Grove Elementary School, Baywood Elementary School, and Sunnyside Elementary School. The schools will utilize the following estimated amounts of recycled water for landscape irrigation:

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- Los Osos Middle School – 25 AFY
- Monarch Grove Elementary School – 5 AFY
- Baywood Elementary School – 7 AFY
- Sunnyside Elementary School – 5 AFY

In addition, the LOCSD currently provides water supply to the community park. The community park will offset an estimated 5 AFY of potable water demand for landscape irrigation.

Sea Pines Golf Course, located on Morro Bay at the northwestern edge of the community, currently receives approximately 15-20 acre feet of recycled water from the Monarch Grove Wastewater Treatment Plant and approximately 75 to 85 acre-feet of water from on-site upper aquifer wells. If the Monarch Grove subdivision is connected to the LOWWP, their wastewater treatment plant will no longer be used, and it is proposed to serve Sea Pines Golf Course with recycled water from the LOWWP at a 1:1 blend with well water. The remaining water would continue to be provided by existing well supplies. Sea Pines Golf Course could utilize an estimated 30 to 45 AFY of LOWWP recycled water.

The Los Osos Valley Cemetery is located on Los Osos Valley Road, adjacent to the proposed treatment plant site. The Cemetery currently pumps potable water from its own private on-site well, which draws from the agricultural area overlying the Creek Valley Aquifer. The County could supply the Cemetery with recycled water, which would offset approximately 50 AFY of potable water use, thus decreasing the demand on the basin. Recycled water supplied to the Cemetery will provide similar benefits to the Basin as the agriculture reuse.

In order to identify users for agricultural irrigation with recycled water, the County completed an outreach program to all agricultural properties overlying the groundwater basin. The Coastal San Luis Resource Conservation District (RCD) assisted the County by coordinating this effort. As a result, the County has completed program participation agreements with the six property owners who expressed interest in receiving recycled water. The properties represent an estimated 80 acres of arable land. The County is now negotiating delivery schedule agreements with the property owners for reuse of an estimated 160 AFY of recycled water.

Due to variations in seasonal deliveries, the County will have on-site storage ponds that will hold up to 50 acre-feet of water to allow flexibility of deliveries to the above mentioned delivery sites.

Permitting

The County will obtain permits through both the Regional Water Board and the California Department of Public Health to ensure that the Recycled Water Facilities meet all Title 17 and Title 22 requirements. The County will be required to closely monitor the recycled water and provide annual reports to the Regional Water Board.

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2.4.2 Irrigation Water Quality Guidelines and Summary

Recommended water quality criteria for general irrigation use is presented in Table 2-2. Actual effluent quality for the Los Osos Wastewater Treatment Plant is not available since the plant is not operational at this time. This table expresses the degree of restriction of recycled water based on sodium absorption ratio in conjunction with salinity (EC).

Table 2-2. Water Quality Summary

Parameter	Degree of Restriction on Use		
	None	Slight to Moderate	Severe
Boron, mg/L	<0.7	0.7-1.0	>3.0
Chloride, mg/L	<140	140-350	>350
TDS, mg/L	<450	450-2,000	>2,000
EC, mmhos/cm	<0.7	0.7-3.0	>3.0
EC, mmhos/cm, with SAR 3-6	>1.2	1.2-0.3	<0.3

2.4.3 Recycled Water Quality Requirements

The Regional Water Board issued Waste Discharge Requirement (WDR) Order No. R3-2011-0001, which regulates the discharge of treated wastewater from the Los Osos Wastewater Treatment Plant. This WDR Permit stipulates the water quality parameters and other general permit requirements for the protection of water quality and public health. Table 2-3 provides the effluent water limits and the recycled water quality requirements.

Table 2-3. WDR Effluent and Recycled Water Limits

Constituents	Unit	Monthly Average (30-day)	Sample Maximum
Effluent Limits to Leachfields			
Settleable Solids	mL/L	0.1	0.5
BOD, 5-day	mg/L	60	100
Suspended Solids	mg/L	60	100
Total Nitrogen (as N)	mg/L	7	10
Recycled Water Limits			
BOD, 5-day	mg/L	30	90
Suspended Solids	mg/L	30	90
pH	s.u.	6.5 – 8.4	

mL/L – milliliters per liter
mg/L – milligrams per liter

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throughout the year. Therefore, approximately 0.7 mgd of recycled water is anticipated to be available year round.

2.6 Projected Basin Benefits and Recycled Water Use Options

The County is required by the CDP to bring recycled water back into the basin for disposal and reuse. The County will be distributing the recycled water through percolation and irrigation in the urban and agricultural areas. Reuse must be prioritized to benefit community water resources and mitigate sea water intrusion. The various options are described in more detail below.

2.6.1 Effluent Recycled Water Percolation

Broderson Site: A portion of the recycled water will be percolated to the Basin via leach fields to be installed on the Broderson site, thus providing a beneficial water supply to the Basin. The Broderson site is a 80-acre parcel located south of Highland Drive in Los Osos. The site slopes down to the north from a maximum elevation of 340 feet above mean sea level (msl) to approximately 200 feet above msl along its northern boundary. The site is currently undeveloped and largely covered with scrub vegetation in its lower half with the upper half occupied by chaparral type vegetation that includes stands of Morro Manzanita. A 2000 hydrogeological study of the site recommended a wastewater disposal rate of 800,000 gallons per day (896 AFY). The study concluded that "daylighting will not occur at this disposal rate between Highland Drive and Los Osos Valley Road due to mounding or lateral movement of perched water along the shallowest perching horizon." Wastewater particles will take at least 1 year to migrate offsite, and 14 years to reach the bay in the upper aquifer. Movement from the site to the Rosina well would take at least 16 years, of which an estimated 11 years is spent moving through a regionally confining clay layer into the lower aquifer.

The leach fields will be constructed on approximately 8 acres of the site; the remainder of the site would be placed in permanent open space and added to the greenbelt surrounding the Los Osos Community. Up to 448 acre feet per year (AFY) of effluent will be discharged at Broderson's 8-acre leach fields. Discharge can occur during wet and dry weather. This discharge is expected to mitigate 99 AFY of seawater intrusion. Five vadose zone monitoring wells will be installed to monitor groundwater quality.

Bayridge Estates Leach Field: The County will utilize the existing Bayridge Estates leach fields, which will no longer be needed as a leach field once the LOWWP is on-line, to percolate approximately 33 AFY of treated effluent. This site provides additional disposal capacity and also mitigates potential impacts to Willow Creek.

2.6.2 Irrigation to Replace Potable Urban Purveyor Water Demand

Schools (Los Osos Middle School, Monarch Grove Elementary, Baywood Elementary, Sunnyside Elementary): The largest consumers of water for the Water Purveyors are the schools. There are four schools within the LOCSD and GSWC service areas and none in the S&T service area. The schools include: Los Osos Middle School, Monarch Grove Elementary

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Ponds will be lined to prevent percolation and the banks protected from erosion. The maximum feasible depth below grade is approximately 15 feet. The freeboard required for any pond would be approximately 4 feet to comply with seismic codes. The footprint required for one 50 AF capacity pond is approximately 5.5 acres. At build-out, storage ponds would require approximately 18 acres.

After storage for several months, the effluent will need to be screened or filtered before being sent for reuse/disposal to reduce algae that could cause clogging. The ponds will be emptied as the ability to accept effluent increases at the urban and agricultural reuse site in the spring and summer. The storage ponds should be nearly empty in the fall.

2.7.4 On-site Infrastructure Improvement Requirements

Urban reuse sites with existing landscape irrigation systems would be retrofitted to allow recycled water to be the primary water source and potable water as a backup source on an emergency basis. Appropriate cross connection control measures, including a reduced pressure back-flow preventer on the potable water service line, would be used. The connection to either water source would be configured with an approved air gap that uses a removable fitting, but does not break head at the connection. For example, the “swivel-ell” configuration developed by the State of California, Department of Health Services uses a single elbow fitting that is rotated to allow connection to either the recycled water system or the potable water system.

2.8 Structured Selection Process for Initial Agriculture Reuse

2.8.1 Process Purpose and Objectives

The County of San Luis Obispo has an objective to return all water from the LOWWP back to the Los Osos Groundwater Basin for beneficial reuse. The County will have between 100 and 200 AFY of recycled water available that is in excess of the planned leachfield percolation or urban reuse. This amount will be used for agricultural irrigation and will meet the required 10% recycled water for agriculture reuse. The County’s objective is to prioritize the agriculture reuse deliveries as it relates to the overall benefits to the groundwater basin and the mitigation of sea water intrusion.

2.8.2 Priority Matrix and Ranking Criteria

The agriculture reuse properties will be ranked based on a priority matrix that is structured as follows:

1. Properties within the Los Osos Groundwater Basin which will offset existing pumping of the groundwater basin by using recycled water. (sea water intrusion mitigation factor = 0.1)
2. Properties within the Los Osos Groundwater Basin which will use recycled water in addition to existing pumping of the groundwater basin. (sea water intrusion mitigation factor = 0.0)

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2.8.3 Grower Outreach and Public Information

The County, in conjunction with the Coastal San Luis RCD, has completed their formal outreach program to inform the growers about the project, schedule, water quality, and costs of recycled water and to answer questions and to develop grower interest. The County has conducted information sessions for the growers and has discussed the project one-on-one with many growers and property owners. Six agricultural owners/growers have signed program participation agreements that were approved on October 25, 2011 by the County Board of Supervisors. These properties provide an estimated 80 acres of agricultural land that will potentially irrigate with the recycled water, and be adequate to meet the reuse requirements for the project.

Outreach will continue throughout the project, before and after the initial agreements have been obtained, to ensure that the growers' needs are addressed and to identify new recycled water users that will provide a greater basin benefit or subscribe to deliveries of future capacity.

2.8.4 Draft and Final Reuse Agreements

The County's outreach program for agricultural reuse of the available start-up flows concluded with the program participation agreements that were approved on October 25, 2011. This action identified the owners/growers that are interested in accepting recycled water from the project at start-up. The County will now develop delivery agreements with the growers that will establish the schedule, quantity, operational factors, and contract duration. It is anticipated that the delivery agreements with the growers will be for approximately 5 to 10 years, in order for growers to recoup their costs for infrastructure investments required to irrigate with recycled water. During this period, the County will continue to outreach to other property owners in the basin for the next round of delivery agreements, after the first term is completed, or to subscribe to flows from new development.

Pricing for the recycled water will be based on negotiations with the property owners who have signed the program participation agreements. Since all existing agriculture production is attained through private well production, the pricing of recycled water will most likely vary significantly. Growers with sufficient well production may only desire to purchase water at discount rates, but those properties with limited well production will be willing to pay higher rates.

2.8.5 Crisis Management Plan (Food Safety)

The County of San Luis Obispo will work with the growers to develop a Crisis Management Plan. The Crisis Management Plan will incorporate standard operating procedures for delivery and testing and the steps that will be implemented if a food safety issue were to occur. A crisis may include, but not limited to failed water quality tests, damage to recycled water infrastructure that would preclude the ability to deliver recycled water to the customers, or to an outbreak of a food related illness, whether or not it is related to the recycled water quality.

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2.8.6 Summary of Adaptive Management Principles for Future Agricultural Reuse

The County of San Luis Obispo will evaluate the recycled water usage annually to determine its efficiency and effectiveness in meeting the goals of the recycled water program. See Section 5.0 for more information regarding adaptive management principles.

2.9 Agency Oversight and Permitting

2.9.1 California Department of Public Health

The California Department of Public Health (CDPH) will permit the recycled water system. CDPH will require the County to submit an Engineer's Report prior to the issuance of the Recycled Water Permit. CDPH will review and approve the conveyance system for the recycled water system as well as the connections to each end user.

2.9.2 Regional Water Quality Control Board

The California Regional Water Quality Control Board, Central Coast Region (Region 3), issued Waste Discharge Requirement (WDR) Order No. R3-2011-0001, which regulates the discharge of treated wastewater from the Los Osos Wastewater Treatment Plant. This WDR Permit stipulate water quality parameters and other general permit requirements for the protection of water quality and public health.

2.10 Implementation Schedule and Phasing

Construction of the LOWWP is expected to commence by mid-2012 and be completed in late-2014. During the construction period, the County will work with each of the participating users, identifying the upgrades that the users will be required to complete and evaluating their needs to convert their systems with the intention for the users to receive recycled water in 2015, following completion of the project and conversion of the private homeowners from septic to the community collection system.

During the initial year of project operations, flows to the system will be limited, as private homeowners gradually abandon their septic systems and connect to the project. There will also be an initial start-up and commissioning period for the new treatment facility, in order to document the ability to reliable produce recycle water that meets State standards for irrigation reuse. During the start-up period, the majority of the recycled water flows will be delivered to the leach fields at Broderson and Bayridge Estates and irrigation uses will be gradually increased.

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Objective 5: Collect data sufficient to evaluate the effectiveness of Basin management strategies. Such strategies are based on certain predictions derived from use of a basin model, prepared by Cleath-Harris Geologists, Inc. It will be crucial for long-term management to test the predicted effect of various strategies on Basin resources against actual data collected as part of this groundwater monitoring program. Such data can be used to confirm and calibrate management actions.

The goal of the EMP is to identify any changes in wetland and riparian habitat areas and habitat values potentially related to decommissioning of the septic systems throughout the community of Los Osos, and to provide remedial actions as necessary to address any such changes. This goal will be accomplished through regular monitoring, data analysis, and adaptive management for the life of the project.

Implementation of the LOWWP EMP will:

- Establish baseline conditions for wetland and riparian resources;
- Ensure annual monitoring and trend analysis of wetland and riparian habitat areas;
- Provide adaptive management measures for remedial action; and,
- Maintain the current function and values of wetland and riparian habitats.

4.3 Coordination with Other Monitoring Programs

The groundwater Monitoring Program for the RWMP for the LOWWP will provide significant overlap with monitoring requirements of groundwater management plans adopted pursuant to state law, the future Basin Plan being prepared by the ISJ Working Group, with the CASGEM, and with the SWRCB Recycled Water Policy. The program managed pursuant to the future Basin Plan, however, is intended to be the primary groundwater monitoring program for the Basin, and other groundwater monitoring efforts undertaken by the County and other Parties will meet any additional requirements as well as be made consistent with the Basin Plan to the extent possible.

4.3.1 Recycled Water Management Plan

The California Coastal Commission has directed the County to prepare a Recycled Water Management Plan, which includes a Monitoring Program, as a condition of approval for the LOWWP. The Monitoring Program required in the RWMP has significant overlap with the data that is planned to be collected for the future Basin Plan, with some key differences. The Basin Plan objectives are to collect and organize groundwater level, quality and production data, along with future wastewater disposal/recycled water use data, but does not provide for collecting ecological monitoring data. The RWMP Monitoring Program will likely rely heavily on the future Basin Plan as a source of data for annual reports, as well as baseline assessment, establishing success criteria, and ensuring its objectives are achieved. The RWMP Monitoring Program will also need to be supplemented with other types of resource monitoring, as described in Section 4.7 “Environmental Monitoring Program.” As the ownership and operations entity for the

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LOWWP, the County will be responsible for collection, compilation and reporting of any data to meet the Coastal Commission requirements.

4.3.2 Groundwater Management Plans

California law authorizes certain types of local agencies to develop, adopt and implement groundwater management plans. The law was originally adopted in Assembly Bill 3030 (1992) and was significantly amended in Senate Bill 1938 (2002). The Basin Plan that is being developed by the ISJ Working Group will meet the intent of the groundwater management plan statute. Additionally, the law contains groundwater monitoring requirements that are helpful in designing a program for the Basin.

The act requires any public agency seeking state funds administered through DWR for the construction of groundwater projects or groundwater quality projects to prepare and implement a groundwater management plan with certain specified components. Requirements include establishing basin management objectives, preparing a plan to involve other local agencies in a cooperative planning effort and adopting monitoring protocols that promote efficient and effective groundwater management. The requirements apply to agencies that have already adopted groundwater management plans as well as agencies that do not overlie groundwater basins identified in Bulletin 118 and its updates.

As part of any groundwater management plan, the law requires local agencies to adopt monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem, and flow and quality of surface waters that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin. The monitoring protocols must be designed to generate information that promotes efficient and effective groundwater management.

The groundwater monitoring program planned for the future Basin Plan will be conducted in conjunction with the RWMP Monitoring Program and meets the intent of these monitoring protocols by collecting, compiling and organizing water level, surface flow and water quality data for efficient and effective groundwater management. Subsidence has not been identified as a potential problem in the Basin and is not part of the groundwater monitoring program. Surface water quality monitoring will be a part of the RWMP Monitoring Program. The primary surface waters to be monitored in the basin are Los Osos Creek, Willow Creek, and bay-front wetlands.

4.3.3 Senate Bill X7 6

In 2009, the California Legislature passed SBX7 6, which established for the first time in California, collaboration between local monitoring parties and the Department of Water Resources (DWR) to collect groundwater elevations statewide and that this information be made available to the public. This legislation led to DWR's formation of the California Statewide Groundwater Elevation Monitoring Program (CASGEM).

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SBX7 6 provides that:

- Local parties, called "Monitoring Entities," may assume responsibility for monitoring and reporting groundwater elevations.
- DWR will work cooperatively with local Monitoring Entities to achieve monitoring programs that demonstrate seasonal and long-term trends in groundwater elevations.
- DWR will accept and review prospective Monitoring Entity submittals, then determine the designated Monitoring Entity for each groundwater basin, notify the Monitoring Entity and make that information available to the public.
- DWR will perform groundwater elevation monitoring in basins where no local party has agreed to perform the monitoring functions.
- If local parties do not volunteer to perform the groundwater monitoring functions, and DWR assumes those functions, then those parties become ineligible for water grants or loans from the state.

The major deadlines for CASGEM are:

- On or before January 1, 2011: Parties seeking to become Monitoring Entities were required to notify DWR. The County and Water Purveyors, through the ISJ Working Group have sought recognition by DWR as the Monitoring Entity for the Basin, until the finalization of the Basin Plan and the formal establishment of the Watermaster, at which time it is anticipated that the Watermaster will assume the duties of the Monitoring Entity.
- On or before January 1, 2012: Monitoring Entities must begin reporting seasonal groundwater elevation measurements. The County and Water Purveyors, through the ISJ Working Group plans to implement a groundwater monitoring program in order to meet this deadline.
- On or before January 1 of each year after, Monitoring Entities must report seasonal groundwater elevation measurements.

The data needs of the CASGEM program will be met by the groundwater monitoring program. DWR field log sheets or equivalent forms will be used in the program, and water level data from eligible wells will be made available for CASGEM program use.

4.3.4 Salt and Nutrient Management Plans

In February 2009, the State Water Board adopted a Recycled Water Policy to encourage the safe use of recycled water and storm water in California. The policy includes a requirement that a salt and nutrient management plan be prepared for each groundwater basin in the state. Salts and nutrients from all sources are to be managed on a basin-wide or watershed-wide basis in a manner that ensures attainment of water quality objectives and protection of beneficial uses. By 2014, interested parties are required to prepare salt and nutrient management plans and submit them to the applicable Regional Water Board for the basin. These implementation plans are to be developed by local water and wastewater entities, together with local salt/nutrient contributing stakeholders. The final plans will be adopted by the Regional Water Board as amendments to the region's water quality plans.

from the old datum. Several wells were re-surveyed in 2003 for the LOCSD Nitrate Monitoring Program, and the sand spit wells were re-surveyed in 2005 for the sea water intrusion study. There are still many wells that have not been re-surveyed, with only approximate elevations available under NAVD 1988. During the first year of the program, an inventory of wells requiring re-survey would be compiled, and a licensed land surveyor retained to establish reference points at each well.

4.6.2 Water Level Monitoring

Groundwater level monitoring typically uses an electric sounder or steel tape. The monitoring technician should have a record of any prior levels at the well for reference. If the well is equipped and in use, depending on the type of well, monitoring should take place following an appropriate period of water level recovery. Coordination with the well owner or operator is recommended where appropriate. The DWR Groundwater Elevation Monitoring Guidelines contain a detailed description of the various water level monitoring procedures, many of which apply to the groundwater Monitoring Program.

4.6.3 Pressure Transducer Operation

A pressure transducer allows for automatic water level data collection between regular monitoring events. These devices are placed below water in a well and record changes in pressure that occur in response to changes in the height of the water column above the transducer. Either vented or non-vented transducers are available from manufacturers. Direct read cables are also available that allow data to be downloaded without removing the transducer from the well. Transducers in the groundwater Monitoring Program would be programmed for 24-hour measurement intervals.

4.7 Environmental Monitoring Program

As noted previously, the Environmental Monitoring Program (EMP) has been prepared for the LOWWP. The Coastal Development Permit Conditions require preparation of an EMP to quantitatively and qualitatively identify changes in wetland, stream, creek, riparian, and marsh plant and animal abundance following implementation of the Basin Plan.

4.7.1 Potential Effects to Wetland Habitats from Project Implementation

Construction of the LOWWP will decommission existing septic systems, thereby removing localized groundwater discharge sources that are spread relatively evenly throughout the community. Following construction of the LOWWP, discharges of tertiary treated water to the upper aquifer will occur at two primary locations (Broderson and Bayridge Estates). The quantity of discharge will require adjustment to ensure adequate groundwater levels are maintained throughout the community. Septic system decommissioning will likely result in temporary localized lowering of groundwater levels as neighborhoods are connected to the collection system; however, these effects will be offset to some extent by the discharge that will be occurring at the Broderson and Bayridge Estates sites. Established wetland and riparian vegetation is expected to react slowly to these initial changes in hydrology or water quality, and

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the monitoring program will attempt to distinguish project-related changes in the amount and composition of wetlands from those resulting from natural factors.

Over the long term, the RWMP is designed to stabilize groundwater levels and, as they stabilize, changes and trends in wetland habitat area and composition may be observed during monitoring under the EMP. The most likely effect will involve changes in vegetative composition in reaction to increased or decreased salt content in the groundwater. If the recycled water program results in reduced fresh water seepage from septage flows, Bay fringe wetlands could transition towards more salt-tolerant species, and willow fringe areas closest to the Bay may decrease. An increase in fresh water seepage would have the opposite effect. In either case, vegetated areas along the Bay fringe will remain inundated at current levels, since tidal activity and water levels in the Bay will not change as a result of the LOWWP. As a result, the extent of Bay fringe wetlands will not likely change following LOWWP implementation, although the mix of fresh, brackish, and salt water vegetation could be altered.

4.7.2 Success Criteria

The CDP requires establishment of Interim and Long-term success criteria for ground and surface water and related resources. For this EMP, the Interim period is considered to be the time between the start of decommissioning to full implementation of the recycled water infrastructure. The Long-term period is considered to be the remaining years that the project is in operation following implementation.

This EMP is intended to document changes in resource conditions; no planting, maintenance, or other direct actions that would affect the habitat conditions present at the monitoring sites are proposed. As a result, the only measurement standard available is the amount of deviance from baseline assessment conditions as documented during annual monitoring efforts.

Total success would consist of no discernable changes in wetland size or vegetative composition over the life of the project; however, gradual changes in vegetative composition are expected to result from establishment of long-term “new normal” site conditions that include drier or wetter soils, or an increase or decrease in groundwater salinity. Since wetland habitats are dynamic natural systems, any such long-term changes identified during annual monitoring efforts could be the direct result of project activities, or could be wholly or partially caused by other factors, such as normal fluctuations in yearly average temperatures and rainfall amounts received, introduction of a new invasive plant species, or new water well installation.

An observed change from wetland to upland habitat would constitute a significant negative result, while the reverse situation of increasing wetland area might also have negative effects on surrounding habitats. Changes in wetland habitat types (i.e., from freshwater to saltwater marsh), may not necessarily be a negative result, and would depend on analysis of the specific conditions.

The EMP includes overall Interim and Long-term success criteria for the monitoring areas identified on Figure 4-4. Success of the Basin with regard to continuance of existing wetland

Figure 4-4. Proposed Monitoring Locations

resource function and value will be determined through analysis of monitoring data and comparison with the baseline conditions documented in Baseline Assessment Report, which will be prepared upon approval of the Recycled Water Management Plan. When a significant deviance from baseline conditions is noted at a site or as a combined total of site conditions, previous weather patterns or other outside influences must be examined, and a determination made regarding whether non-project related factors are contributing to the monitoring results.

Interim Success Criteria

The Interim period constitutes the approximate two-year decommissioning and recycled water implementation period, and is expected to be too short to document gradual changes in resource conditions. Any vegetative changes occurring in monitored areas during or immediately following septic decommissioning will be the result of a rapid and significant change in groundwater levels resulting in drier or wetter soil conditions, or a rapid increase or decrease in groundwater salinity. The result could be a loss of wetland habitat area or changes in vegetative composition of wetland habitats. These changes would be likely related to the decommissioning process, but could also be influenced by abnormal weather conditions during the Interim period. Interim period success criteria are as follows:

- Wetland and riparian areas monitored under this EMP will maintain hydrologic functions and will continue to support wetland / riparian plant species.
- Wetland and riparian areas monitored under this EMP will continue to meet the California Coastal Commission one-parameter definition of wetland habitat and will exhibit evidence of native plant recruitment and wildlife usage.

These criteria are based on maintenance of groundwater depth and salinity levels at or near baseline conditions during decommissioning, such that rapid changes in vegetative composition do not occur. If vegetative loss or change is noted during Interim period monitoring visits, remedial actions will be taken to address the problem.

Long-term Success Criteria

The Long-term period consists of the years that the project is in operation following implementation. Over this period, gradual changes in groundwater levels or gradual changes in salinity levels are expected to be recorded by the groundwater monitoring program, and could result in gradual vegetational changes that could be documented by monitoring conducted under this EMP. Expected changes would consist of loss of wetland habitat or a shift in vegetative composition of wetland habitats. It is less likely that groundwater levels will rise to a point that would cause wetland habitats to increase in size, and riparian areas containing deep-rooted plants such as willows would likely not be affected by a minor decrease in groundwater levels.

The success criteria for the Long-term monitoring effort consist of the following requirements:

- Species composition, percent cover, and wetland/riparian acreage as documented at each site during annual monitoring efforts will remain within 25% of the baseline conditions over the life of the project (after allowance for annual weather variations).

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- Wetland and riparian areas monitored under this EMP will maintain hydrologic functions and will continue to support wetland / riparian plant species.
- Wetland and riparian areas monitored under this EMP will continue to meet the California Coastal Commission one-parameter definition of wetland habitat, and will exhibit evidence of native plant recruitment and wildlife usage.

Achievement of the long-term success criteria will indicate that water re-use inputs are at levels sufficient to maintain current hydrologic conditions and support existing wetland habitats with little overall change in plant composition or habitat type other than normal fluctuations resulting from weather. Conversely, a documented failure to meet the criteria would be considered a significant event requiring adaptive management analysis and immediate remedial actions.

Baseline Data Collection

To provide valid comparisons, baseline data must be collected prior to start of septic tank decommissioning and at the same time of year that the annual monitoring effort will be conducted. The most useful monitoring period would be late summer or fall, at the driest time of the year. This time period will minimize the effect of the rainy season on groundwater levels and would be most likely to expose any vegetative stress or habitat changes. Baseline data collection be completed by September 2014 and annual monitoring will also be conducted in September.

4.7.3 Monitoring Locations

Six sites have been identified as primary monitoring locations to provide quantitative data to document the effects of LOWWP implementation on wetland resources (refer to Figure 4-4 and Table 4-3). Four secondary monitoring locations have also been identified to provide additional qualitative monitoring data on wetland resources in the area. These primary and secondary monitoring locations consist of surface water features identified by the 2009 LOWWP EIR hydrologic analysis as at least partially supported by groundwater discharge from the Los Osos Basin, and as an indication of existing shallow groundwater conditions in the east and west groundwater basins. The primary sites will provide quantitative monitoring information on western basin bayfront wetlands and on eastern basin Willow Creek wetland and riparian areas. The secondary sites will provide additional qualitative information and photo reference data for use in assessing overall habitat conditions and trend analysis over the life of the project.

All monitoring sites are in the vicinity of existing groundwater monitoring well locations, and data and trends documented during annual monitoring efforts can be correlated with available monitoring well information.

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Table 4-3. LOWWP EMP Monitoring Locations

Monitoring Location*	Habitat Type	Monitoring Practice	Monitoring Frequency	Monitoring Well Correlation**
Primary Monitoring Sites				
1) Pecho Marsh at Solano St/Butte Drive	tidal/saltwater marsh	Quantitative Transect Analysis	Annual	FW2, UA3
2) Sweet Springs Marsh at Broderson Avenue	tidal/saltwater marsh	Quantitative Transect Analysis	Annual	FW1
3) 3rd Street Marsh at Pismo Avenue	freshwater stream/marsh	Quantitative Sample Area Analysis	Annual	FW12, UA5
4) Baywood Marsh at 7th Street	bayfringe willow wetland	Quantitative Transect Analysis	Annual	FW8, FW9
5) Willow Creek tributary at LOVR and Los Olivos Avenue	freshwater riparian	Quantitative Sample Area Analysis	Annual	LA20, FW19
6) Willow Creek at Nipomo Avenue	freshwater stream	Quantitative Sample Area Analysis	Annual	FW23
Secondary Monitoring Sites				
7) Pasadena Coastal Access	tidal/saltwater marsh	Visual and Aerial Photo Analysis	Annual	LA11
8) Ferrell Avenue Seep	freshwater willow wetland	Visual and Aerial Photo Analysis	Annual	FW14
9) Doris Avenue Marsh	tidal/brackish water marsh	Visual and Aerial Photo Analysis	Annual	FW1
10) Willow Road Marsh	freshwater marsh	Visual and Aerial Photo Analysis	Annual	FW23

*Locations are mapped on Figure 2.

**Monitoring well designations: FW=First Water, UA=Upper Aquifer, LA=Lower Aquifer.

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4.8 Program Implementation

Implementation of the County's Groundwater Monitoring Program will be coordinated by the County with the Water Purveyors and private well owners. Basic tasks are outlined as follows:

- Perform wellhead surveys to establish reference point elevations and locations as needed. A licensed land surveyor would be required.
- Establish well monitoring protocols.
- Adopt a set of procedures for recording groundwater elevations and sampling for water quality.
- Assign water quality and level monitoring responsibilities to each stakeholders. This may consist of supplementing the existing County semi-annual water level monitoring program with monitoring by local Purveyor staff.
- Contact private well owners to request permission for participation in the groundwater elevation and water quality portions of the groundwater monitoring program (including future CASGEM program and salt and nutrient management plan monitoring program). A final list of monitoring locations will be prepared following this task.
- Assign data compilation, organization and reporting duties.
- Perform all monitoring and sampling for the Environmental Monitoring Program.

4.8.1 Program Phasing

The groundwater monitoring program will be completed in three phases: Historical, Start-up, and Maintenance.

Historical: The County will work with the Water Purveyors to obtain records of the historical data regarding each of the wells to be used for the groundwater monitoring program. This data will be compiled prior to the start-up of the LOWWP.

Start-up: Prior to start-up, the County will conduct monitoring for those components within the groundwater monitoring program that does not have historical data available, but is required to establish a baseline for the impacts that the LOWWP may have on the environment. The County will also complete the Baseline Assessment of current conditions of wetlands and riparian areas that are designated to be monitored.

Maintenance: The County, Water Purveyors, and others will conduct the on-going monitoring required in the RWMP Groundwater Monitoring Program and other programs. The monitoring is conducted at various times throughout the year, based on the need of the entity that is being monitored. The County will conduct the on-going monitoring required in the Environmental Monitoring Program. All monitoring activities will be reported annually (See Section 5).

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SECTION 5: REPORTING AND ADAPTIVE MANAGEMENT PROGRAM

Annual reports (two copies) documenting implementation and effectiveness of the Basin Plan shall be submitted to the Executive Director for review and approval by December 31st of each year that the project operates. Each report shall include all monitoring data (including documenting all recycled water reuse for the proceeding year, all water conservation efforts and effects, and all resource changes identified), shall describe the progress towards achieving the success criteria of the plan, and shall make recommendations, if any, on changes necessary to better meet Basin Plan objectives and achieve success. On the latter, the annual reports shall be premised upon the concept of adaptive management that responds to information developed and effects better understood over time in association with the project, and is intended to all for project changes covered by this CDP, unless the Executive Director determines that a CDP amendment is necessary, through the annual report approval process provided that such changes result in better resource protection and better means to achieve Basin Plan objectives over the long-term. Changes, including identified remediation steps, shall be completed per the timetable identified in any approved annual report, or within 30 days of report approval where no such timetable is specified (Special Condition 5d).

5.1 Introduction

Management of the groundwater basin will be essential to its long term sustainability to provide the community of Los Osos with a reliable and safe drinking water source and to ensure the continued viability of wetlands and other sensitive resource areas. Monitoring the groundwater basin over time as it continues to change due to modifications in pumping and reuse will provide the County, the Water Purveyors and other interested parties the ability to make adjustments to the management of the Basin.

5.2 Purpose and Objectives

The purpose of the Reporting and Adaptive Management Program is to provide the final “check and balance” for the Recycled Water Management Program to ensure that the overall objectives of the groundwater basin are being met. Evaluating the groundwater basin on an annual basis allows the County to:

- Evaluate the trends of the groundwater basin
- Identify any voids in the collected data
- Report the data analysis to the various interested parties (Department of Water Resources, Regional Water Board, Coastal Commission)
- Modify the Recycled Water Management Plan based on the current conditions and visible trends of the groundwater basin
- Modify procedures to utilize current best management practices
- Modify pumping, treatment and/or reuse procedures if groundwater basin trends are showing signs of degradation of water quality, including increased levels of contamination and/or increased levels of seawater intrusion

5.3 Annual Report Administration

5.3.1 Submittal Date and Schedule

A groundwater monitoring report will be prepared on an annual basis. The report will be prepared by the County for submission to the Coastal Commission Executive Director, in cooperation with the Water Purveyors and other interested parties. The Annual Report will be prepared for each calendar year, January 1 through December 31, for each year that the LOWWP operates. Two copies of the annual report will be submitted no later than December 31st following the year of monitoring. (i.e. The annual report for 2015 will be submitted no later than December 31st, 2016.) The County will be either preparing or participating in the preparation of at least two other related annual reports. The first is the annual report for the Regional Water Board. This report will include all requirements set forth in the LOWWP's Waste Discharge Requirements. This annual report is due no later than January 30th following the reporting year. The second report will be an annual report to be prepared under the Basin Plan that is being developed by the ISJ Working Group. This annual report will provide data on the groundwater monitoring and status of the basin water quality and supply. Each report will provide similar data and therefore will be completed concurrently and cooperatively.

The following is the proposed schedule for the annual reporting:

- <u>January 1st through December 31st of Monitoring Year:</u> Conduct on-going groundwater and environmental monitoring, per the Monitoring Program. Compile data into electronic database per Section 5.3.2 as monitoring results are obtained throughout the year.
- <u>November 1st of Monitoring Year through January 31st of Reporting Year:</u> Evaluate data and provide analysis of trends, comparisons, etc to historical data. Provide technical memorandum discussing findings of the analysis. County to submit Annual Report by January 30th to the Regional Water Board.
- <u>January 31st through March 1st of Reporting Year:</u> Evaluate the findings and determine if the findings are representative of the current conditions, are showing trends that may unfavorably impact the Basin, and/or are meeting the objectives of the Recycled Water

shall be included in the annual report, along with a timetable for implementation of the recommended measures.

- **Program Changes Implemented in Prior Year:** The report will discuss any changes made to the Monitoring Program. The report will also discuss the reasons for the change and the impacts the change has made to the program. The report will provide copies of executed contracts, schematics or drawings of the changes made, or any other relative information that provides back up for the changes that were implemented.
- **Recommended Program Adjustments or Additional Data Needs:** The report will provide a discussion on recommended program adjustments to enhance the program. This may include, but not limited to additional data needs or program modifications that will provide better data to evaluate the effectiveness of the monitoring program.

5.5 Adaptive Management

Adaptive Management is used to provide guidance on the overall effectiveness of the Recycled Water Management Program, the Water Conservation Program, and the Monitoring Program and to provide a tool with which to modify the programs to better meet the overall Basin objectives. The Adaptive Management process is to ask and answer the following questions:

- Are all Programs reaching targeted objectives? If yes, are there any factors that might change the Programs from continuing to reach targeted objectives? If no, why are the Programs not reaching targeted objectives?
- What changes need to be made to reach the targeted objectives?
- What is the schedule for getting the Programs back on target to reaching objectives?

Each program of the RWMP will contain an Adaptive Management analysis which will include the following:

- Evaluation of recent changes made in prior years
- Summary of recommendations and projected benefits
- Project cost impact of program changes
- Anticipated implementation schedule
- Documentation and public information

If negative trends or subsequent failure to meet the success criteria occur, such trends are expected to occur slowly over several years, and will likely take equal or more time to reverse. Identified problem areas will be addressed through the Adaptive Management analysis to identify suitable remedial action.

For example, if an annual monitoring report indicates that one or more of the EMP monitoring sites is not achieving the success criteria, the County will analyze the situation, determine the reasons for the deficiencies, and take remedial actions as necessary. The analysis will allow identification of suitable measures and methods tailored to the specific site conditions that will

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reverse negative trends and restore wetland habitat characteristics to levels that meet the success criteria. Since any negative trends will be related to changes in groundwater levels or salinity, such measures could include the following actions:

- Adjusting harvest well quantities to raise or lower groundwater levels;
- Artificial watering of wetland areas by water truck or fire hydrant;
- Redirection of road or storm drain runoff to nearby wetland areas;
- Removing sediment deposits in wetland areas to allow ponding to occur; and,
- Removal of non-native or invasive vegetation.

All monitoring sites that receive remedial actions to correct negative trends shall be monitored twice a year until the site achieves compliance with the long-term success criteria.

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SAN LUIS OBISPO COUNTY
DEPARTMENT OF PUBLIC WORKS
Paavo Ogren, Director
County Government Center, Room 207 ◦ San Luis Obispo, CA 93408 ◦ (805) 781-5252
Fax (805) 781-1229 email address: pwd@co.slo.ca.us

August 19, 2009

Kurt Souza, P. E.
California Department of Public Health
1180 Eugenia Place, Suite 200
Carpenteria, CA 93013-2000

Subject: Los Osos Wastewater Project—Recycled Water and Harvest Wells

Dear Mr. Souza:

Thank you for discussing the effluent disposal issues of the Los Osos Wastewater Project with me and, separately, with our Public Works Director, Paavo Ogren. The intent of this letter is to provide a written confirmation of our understanding of these issues, as they relate to the purview of the Department of Public Health and the draft groundwater recharge regulations.

We understand that the proposed use of the Broderson site, for the disposal of up to an annual average of 448 acre-feet per year of disinfected tertiary recycled water, per Title 22 standards, is appropriate to consider as a disposal project. Concurrent with project implementation, verification will be provided with a monitoring well program to ensure the protection of groundwater quality.

However, any increased application at Broderson, or elsewhere in the community, to rates that would necessitate harvest wells for the subsequent extraction of recycled water, with the intent to blend the harvest well water with the potable water supply, would most likely be considered a groundwater recharge reuse project (GRRP). Such projects are subject to the draft groundwater recharge regulations and, as such, the wastewater effluent would require additional treatment and monitoring prior to disposal to the groundwater basin. The additional treatment requirements include reverse osmosis and advanced oxidation. Additionally, the wastewater effluent would be required to be blended 50%/50% with water that is not of wastewater origin for a minimum of one year. After one year, the percentage of recycled water could be incrementally increased, based on water quality monitoring results.

We continue to work with the Los Osos water purveyors, through the cooperative process established under the existing groundwater litigation, to develop a basin management plan that will address the current overdraft and protect water quality. Recent hydro-geological studies completed for this process are encouraging. They suggest that it is feasible to manage the groundwater basin, within its safe yield, through the increased development of existing upper aquifer yield without the need for wastewater project harvest wells. If successful, more aggressive and costly measures, such as a groundwater recharge project, would not be necessary to balance the basin.

If you have any questions, or would like to provide further input on these issues, please contact me at (805) 788-2713.

Sincerely,

JOHN WADDELL, P. E.
Project Engineer

c: Paavo Ogren, Director of Public Works
Mark Hutchinson, Environmental Programs Manager

File: CF 310.87.02

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August 6, 2009

President
Joe Sparks

Vice-President
Marshall Ochylski

Director
Chuck Cesena
Maria Kelly
Steve Senet

General Manager

Utilities Manager
George J. Milanés

Fire Chief
Matt Jenkins

TO: LOCSD Board of Directors

FROM: Mitch Cooney, Interim General Manager

SUBJECT: Agenda Item 5B – 08/06/09 Board Meeting
Discussion of Option to Enter into an Interagency Agreement with the County of San Luis Obispo for the Development of Harvest Wells

SUMMARY

As part of the wastewater project, it has been suggested that Harvest Wells be developed to augment, after a blending process, the District's water supply. In order to ensure that this concept is considered as part of the wastewater project, it is recommended that the Board of Directors discuss and refer this issue to the Water Advisory Committee so that they can return to the Board of Directors with recommendation(s) to enter into an Interagency Agreement with the County of San Luis Obispo for the development of Harvest Wells as part of the waste-water project.

Financial Impact

Other than the expenditure of staff and Legal Council time, there would be no financial impact to the District. The cost of the development of Harvest Wells would be part of the waste-water project.

THE RECOMMENDED ACTION BEFORE YOUR BOARD is to: by Board discussion, public comment, motion, second and vote to refer the issue of an Interagency Agreement with the County of San Luis Obispo for the development of Harvest Wells to the Water Advisory Committee and direct that the Water Advisory Committee return to the Board of Directors their findings and recommendations.

Offices At:
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Los Osos, California 93402

Mailing Address:
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www.losososcsd.org

Report of the Los Osos Valley Groundwater Basin, August 2000; Management Scenario, Los Osos valley Groundwater Basin, August 14, 2000).

The following recommended management practices are based on the URS/Team Engineering Management Scenario Report:

- Perform maximum possible wastewater disposal at the Broderson site. Shifting some disposal to the east side of community would help mitigate potential sea water intrusion at the 3rd Street and 8th Street wells but is not necessary for basin-wide management.

- Connect CCW (California Cities Water) and LOCSD systems if sea water intrusion occurs following implementation of GBMP alternative pumping program. This reduces pumping of well closest to the Bay, thus minimizing the potential for sea water intrusion.

- Shift purveyor production at build-out, at least during the peak demand months, to inland wells.

WATER SYSTEM SUPPLY SOURCES ASSESSMENT

The water supply source facilities for the Los Osos Community Services District (LOCSD) consist of five active ground water wells and one inactive well which produce from the Los Osos ground water basin. The assessment of existing water source facilities includes an evaluation of each well with respect to source capacity, an assessment of pumping practices, and Title 22 compliance. Below is a summary of the findings.

- The Los Osos CSD wells have a system capacity **of 1,580 gallons per minute** which exceeds the historic maximum daily demand of 1,176 gallons per minute. With select pump replacements, maximum system capacity with the existing wells could be 1,950 gpm.

- Water supply and water storage capacity meet Title 22 requirements. The main water quality concerns in the basin are nitrates and sea water intrusion.

- New well sites may be considered to produce water from the shallow aquifer in the western basin compartment and in the shallow and deep aquifers within the eastern basin compartment. A reduction in production from the West side compartment is necessary to stop sea water intrusion.

HARVEST WELL PRODUCTION TO AUGMENT DEEP AQUIFER SUPPLY

As part of the Los Osos wastewater project, the LOCSD will be embarking on a large-scale project to sewer the community within the prohibition zone defined by the Regional Water Quality Control

Board. As part of the treated effluent disposal system, leach fields will discharge the tertiary treated water from the LOCSD wastewater plant into the underlying upper groundwater zone. Since the groundwater will be percolating in "localized" areas as opposed to individually by wide-spread private septic tank/leach field systems, there is the potential for localized mounding of the groundwater in the areas of the proposed leach fields. Harvest wells will need to be installed, to extract groundwater down gradient of the proposed leach fields.

This harvested groundwater may be blended with potable water to augment the potable water supply, and may also be used to meet the recycled water demand (see Chapter 6). This section focuses on the potable water element, using harvest well water to augment the LOCSD water supply. Basin-wide, it is estimated that approximately 650,000 gpd (730 AFY) of water must be pumped from the upper aquifer to prevent localized groundwater mounding. This groundwater, once extracted, will be suitable to blend with potable water, such that the blended product water will meet all drinking water standards, and specifically, nitrate concentrations (below 45 mg/L NO_3). Over time, the groundwater basin will improve with respect to nitrates, and the blending ratios of deep aquifer water to upper zone harvest well water will lessen over the years. The actual blending ratios and details of this option will be provided under a separate technical memorandum to be prepared by Montgomery Watson Harza during the design phase.

SUPPLEMENTAL WATER SUPPLY WELLS

With the Palisades Well supplying nearly 50 percent of the total LOCSD water supply, consideration must be given to the ability of the remaining wells to supply maximum day demand in the event that the Palisades Well is out of service. Should this be the case, the District will not be able to meet build-out maximum day demand of 1,869 gpm. The Palisades Well alone can provide 750 gpm (maximum sustained flow during peak month), while the other wells collectively produce 830 gpm. In addition, this same deficiency exists today, should the other system wells need to meet current maximum day demand of 1,585 gpm.

The projected deficit to meet maximum day demand considers the future water harvesting wells, estimated to produce 650,000 gpd (451 gpm), and "credits" for recycled water use at Los Osos Middle School and Baywood Elementary School (refer to Chapter 6). For these two school, the peak month demand was considered as a "credit" towards meeting the potable water demand. Collectively, recycled water irrigation at these two schools would lessen the maximum day demand by 84 gpm. The credits and deficits are summarized in Table 5-3. Based on this analysis, it is recommended to construct two new production wells that will provide a total of 1,000 gpm to ensure that maximum day demand can be met in the event that the Palisades Well is out of service. The recommendation allows for variance in blending ratios of the harvest wells with the new production wells. It is recommended that the location of new production wells be coordinated and located as closely as possible to proposed harvest wells, to minimize the cost associated with dedicated harvest well pipelines from the harvest well to the point of blending at the deep aquifer well. It is envisioned that the two new deep aquifer wells could be located near the Paso Robles and Scenic harvest wells,

Table 5-3. Summary of Credits and Deficits for Existing Well Supply System

Item	Existing	Future Build-Out
Palisades Well Supply	750 gpm	750 gpm
Other LOCSD System Wells Supply	830 gpm	830 gpm
Total Well Supply	1,580 gpm	1,580 gpm
Maximum Day Demand	**1,585 gpm**	**1,869 gpm**
Water Harvesting Well (credit)	----	(160 gpm)[1]
Los Osos Middle School Water Recycling (credit)	----	(70 gpm)
Baywood Elementary School (credit)	----	(14 gpm)
Supply Deficit With Palisades Well Out of Service	**755 gpm**	**795 gpm**

[1] Assumes 20% blending ratio with proposed production wells.

as shown on Figure 5-1. Also, the existing El Moro potable water well could easily be supplied with harvest water from the planned El Moro harvest well. The required blending facilities at each potable water wellhead would include piping the harvested water to the potable well, valving, in-line static mixer, disinfection equipment, flow metering, and telemetry/controls to regulate the blending ratios of the deep aquifer and harvest well waters. The cost for providing the needed blending facilities, valving, flow meter and controls is estimated to cost approximately $25,000, excluding the disinfection facilities. For the two new deep aquifer wells, the cost for such blending facilities is included in the overall capital improvement program (CIP) costs identified in Chapter 8. Both wells should be designed to discharge into the proposed hydro-pneumatic zone. The main zone will then be fed through pressure reducing valves between the zones.

Table 5-3. Summary of Credits and Deficits for Existing Well Supply System

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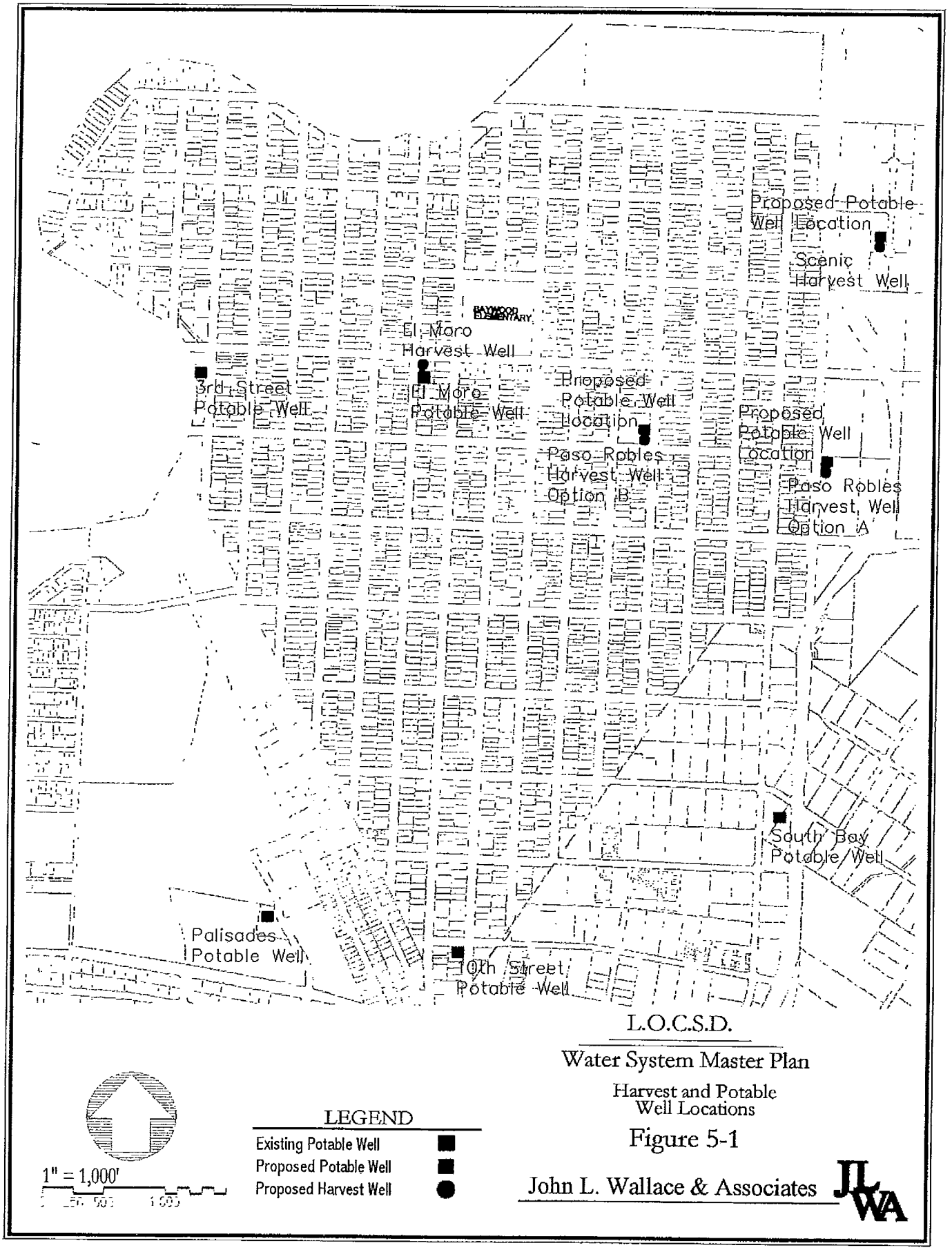
Proposed Potable Well Location
Scenic Harvest Well
BAYWOOD ELEMENTARY
El Moro Harvest Well
3rd Street Potable Well
El Moro Potable Well
Proposed Potable Well Location
Proposed Potable Well Location
Paso Robles Harvest Well Option B
Paso Robles Harvest Well Option A
South Bay Potable Well
Palisades Potable Well
10th Street Potable Well
L.O.C.S.D.
Water System Master Plan
Harvest and Potable Well Locations
Figure 5-1
John L. Wallace & Associates
JLWA
LEGEND
Existing Potable Well
Proposed Potable Well
Proposed Harvest Well
1" = 1,000'

Brownstein | Hyatt Farber | Schreck
A Strategic California Merger with Hatch & Parent

C. Wesley Strickland
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May 27, 2009

VIA ELECTRONIC MAIL

San Luis Obispo County Planning Commission
County Government Center
San Luis Obispo, CA 93408
planningcommission@co.slo.ca.us

RE: Los Osos Wastewater Project Development Plan / Coastal Development Permit County File Number: DRC2008-00103—Hearing Date: May 28, 2009; Agenda Item 4

Dear Hon. Commissioners:

Golden State Water Company (GSWC) submits these comments in response to the San Luis Obispo County Planning Department Planning Commission (Planning Commission) action to consider a request by the County of San Luis Obispo for a Development Plan/Coastal Development Permit to allow construction and operation of a sewer system to serve the community of Los Osos (LOWWP).

GSWC has reviewed the Draft and the Final Environmental Impact Report for the County of San Luis Obispo Los Osos Wastewater Project, State Clearinghouse No. 2007121034 (DEIR) and (FEIR). GSWC previously provided comments on the DEIR dated January 30, 2009. To the extent that those previous comments have not been adequately addressed, GSWC resubmits those comments for consideration by the Planning Commission. These comments have been attached and are incorporated herein by reference. In addition to those previously submitted comments GSWC has the following concerns.

1. <u>Return of Water to the Basin</u>

The proposed effluent disposal methods under the LOWWP Preferred Project include sprayfields at the Tonini parcel and leachfields at the Broderson parcel. The vast majority of the water is being exported from the Los Osos Groundwater Basin (Basin). According to the FEIR, the operation of the LOWWP will result in removing approximately 842 AFY from the Basin and leaving in the Basin 448 AFY. Currently the Basin is in Severity Level III, suffers from overdraft in the lower aquifers, and seawater intrusion is threatening the water supply. There is simply no room to remove any water from the Basin on a long term basis. There must be assurances that

all the water will be returned to the Basin and a realistic timetable should be included in the Planning Commission process.

The Planning Commission is ultimately responsible for overseeing growth in the County. Providing project approval for a plan that exports the majority of water from the Basin with no assurances for its return is not a prudent course of action. Approval would be contradictory with the state policy of maximizing reclamation opportunities wherever possible.

The FEIR states: "During dry weather, the majority of the treated effluent will be directed to the Tonini sprayfields with lesser amounts conveyed to the Broderson leachfields…..The planned operational scenario at Broderson is to operate the disposal leachfields at a rate ***of up to*** 800,000 gallons per day (gpd), disposing of a ***maximum of*** 448 ac-ft of effluent at Broderson during the entire year." (See FEIR p. Q.3-36) Additionally it is planned that for the first two to three years of operation, LOWWP operators expect to limit total disposal at Broderson to 200 AFY to verify the results of the various hydrogeological studies.

The seasonal operational and buildout plan for Broderson do not adequately mitigate for the removal of the water from the Basin. Under the County's best case scenario there will be a maximum of 448 afy left in the Basin. Failure to require a plan with a timeline for return of all of the water to Basin is an irresponsible unacceptable approach.

As of this evening, we have been provided with a document that appears to show that the County would accept a condition on the LOWWP approval that all effluent would be returned to the Basin for beneficial use in the Los Osos community. While we have not had time to fully evaluate that document or discuss it with County staff or attorneys, as a general matter we would support the Planning Commission's imposition of such a condition.

2. <u>Conservation Measures</u>

The County attempts to address seawater intrusion resulting from the removal of the septic tanks in two main ways. It claims the Broderson leachfield site will result in 99 AFY of seawater intrusion mitigation; additionally the County claims the conservation program would provide 88 AFY of seawater intrusion mitigation. Both of these mitigation measures are based on unknown and untested plans. The conservation measures are simply hypothetical with no realistic plan being analyzed to achieve the much needed seawater intrusion.

Currently the majority of water is not used outdoors in the Los Osos community. Also the community has already been aggressive in implementing conservation measures. These two factors will make it extremely difficult to hit the target of 160 afy.

The mitigation factor assigned for conservation measures is not accurate. The FEIR claims conservation will be realized as a reduction of pumping from the over drafted lower aquifer system. There has been no analysis as to what part of basin reduction will be occurring—e.g. if

the conservation is to occur in the eastern part of the Basin the mitigation factor will be not as effective to combat seawater intrusion.

Currently there is no plan on how the conservation plan will be funded or how reduction measures will be implemented. GSWC can only offer voluntary programs and cannot commence mandatory action without the California Public Utility Commission's approval. The County does not have the authority to mandate reductions in pumping. Given the Los Osos community has already made robust efforts to conserve any program that has a chance at reaching the 160 afy reduction goal will be expensive.

Notwithstanding, these major flaws with the County's conservation plan it remains one of the two major methods for seawater mitigation from the impact of the LOWWP. While GSWC supports water conservation measures in general, more specifics of funding and implementation are necessary before the Planning Commission should approve the LOWWP.

3. Broderson Operation

Currently the FEIR makes vague references to the groundwater monitoring program for the Broderson Operations—Generally it provides:

- Use 5 existing wells for vadose zone monitoring near Broderson leachfield.
- Develop groundwater monitoring program using existing water supply and water quality monitoring wells to observe impacts to Los Osos area surface water features. (See FEIR p. Q.5-6.)

There needs to be a detailed monitoring and operational plan in place for the Broderson site. GSWC operates potable drinking water wells in the vicinity of the Broderson site. Adequate funds should be set aside by the County to provide for an independent review of the Broderson operations. A special technical review committee should be established to review the monitoring and operations plan. A proper plan to address the impact of concentrating nonregulated contaminants needs to be in place. These are some steps that should be required in the LOWWP to help ensure the water supply for the community of Los Osos is being protected. More analysis, funding, and assurances are needed.

4. Conclusion

Before the Planning Commission takes action on the Los Osos Wastewater Project Development Plan / Coastal Development Permit it needs to ensure it has a long term project that has assurances that the Basin will not severely impacted by its actions. Currently there is no plan in place to maintain the majority of water in the Basin. The Conservation measures and the Broderson site operations do not provide for sufficient detail to ensure seawater intrusion is not

drastically increased over pre-project conditions. GSWC welcomes questions or responses to these comments, and looks forward to resolution of these issues.

Sincerely,

C. Wesley Strickland

CWS/gml

cc: Paavo Ogren, County of San Luis Obispo, Dept. of Public Works
John Waddell, County of San Luis Obispo, Dept. of Public Works
John Schempf, Los Osos Community Services District
David Tolley, S&T Mutual Water Company
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Technical Memorandum

Date: July 29, 2009

From: Spencer Harris

To: ISJ Group

SUBJECT: **Flow Model Conversion and Urban Area Yield Update**

This memorandum documents revisions to the basin groundwater model and presents results of updating basin yield estimates using the revised model. The yield estimates include current conditions and two wastewater project scenarios (spray field only and VPA2b). The scope of work was performed in accordance with sub-tasks 3 and 4 of the ISJ consulting agreement dated December 17, 2008. Basin yield updates in this memorandum do not include potential development of surplus water in the Creek Valley, which is addressed separately.

Initial yield evaluations using the equivalent fresh water head (EFH) model confirmed that the analysis would be more rigorous and would provide more useful information to the ISJ group if the basin model was converted to full dual-density capability. An increased level of effort was given to sub-task 4 to successfully upgrade the basin model within the project schedule.

This memorandum includes several hypothetical examples of pumping patterns in the basin, including distribution of pumping between upper and lower aquifers and the three local water purveyors. These hypothetical examples were chosen by Cleath-Harris Geologists in order to test the basin yield under various potential future scenarios, and do not necessarily represent pumping patterns that are planned or agreed-upon by the water purveyors. There are a number of factors that must be taken into account by the water purveyors when determining any potential future basin water development, including but not limited to, ownership of land parcels, location of other water infrastructure, regulatory permitting requirements, allocation of water resources, and cost.

Prior Estimate

The basin yield was last estimated in the Draft LOCSD Water Management Plan (Cleath & Associates, 2005a). Under current conditions, basin yield was listed at 3,250 acre-feet per year (AFY), of which 800 AFY was for the creek valley, and 2,450 AFY was for the urban area.

Model Revisions

The original steady-state groundwater model was constructed in 2003 (Yates and Williams, 2003; Cleath & Associates, 2003) and updated in 2004 (Cleath & Associates, 2004). The model was subsequently converted to simulate sea water intrusion using Equivalent Freshwater Head (EFH) methodology in 2005 (Cleath & Associates, 2005b) and updated to current condition pumping in 2008 (Cleath & Associates, 2008).

In the Los Osos groundwater basin, the primary constraint on yield is sea water intrusion. The EFH model characterized sea water intrusion at the coast and has been useful for quantifying and comparing hydrologic budget items under various basin stresses. The EFH model, however, cannot simulate the movement of sea water inland of the coast.

For a basin yield analysis, understanding the transient, inland impacts on water quality from sea water intrusion is necessary for setting pumping thresholds and planning horizons that are appropriate for the existing water system infrastructure. This is only possible through conversion of the EFH model to a true dual-density model.

Density-dependent flow is now simulated in the basin model using the SEAWAT code, which was developed by the U.S. Geological Survey and combines MODFLOW and the solute transport package MT3DMS, while applying a density correction. Sea water intrusion is modeled over time as total dissolved solids (TDS), of which close to half of the mass is chloride.

Setting up the SEAWAT model involved the following changes to the EFH model:

1) Replace the general head boundaries at the ocean with constant head boundaries at mean sea level.

2) Install constant concentration boundaries at the ocean, with a TDS concentration of 2.185 pounds/cubic foot (35,000 mg/l) in Layer 1 (aquifer Zone C) and Layer 4 (Aquifer Zone E). The TDS concentration of Layer 3 (Zone D) was set at 1.093 pounds/cubic foot (17,500 mg/l) to reflect the existing maximum concentration in Zone D at the coast. Although the concentrations in Zone D at the coast could ultimately increase to sea water equivalent with continued intrusion, there has been little change on the sand spit in Zone D quality over the last 20 years, which is evidence of a significant brackish water reservoir offshore. Layer 2 (regional aquitard) is no-flow at the coast.

4) Convert from steady-state to transient modeling. The length of the simulations range from 50 years (calibration) to several thousand years (steady-state sustainability test).

Model Calibration

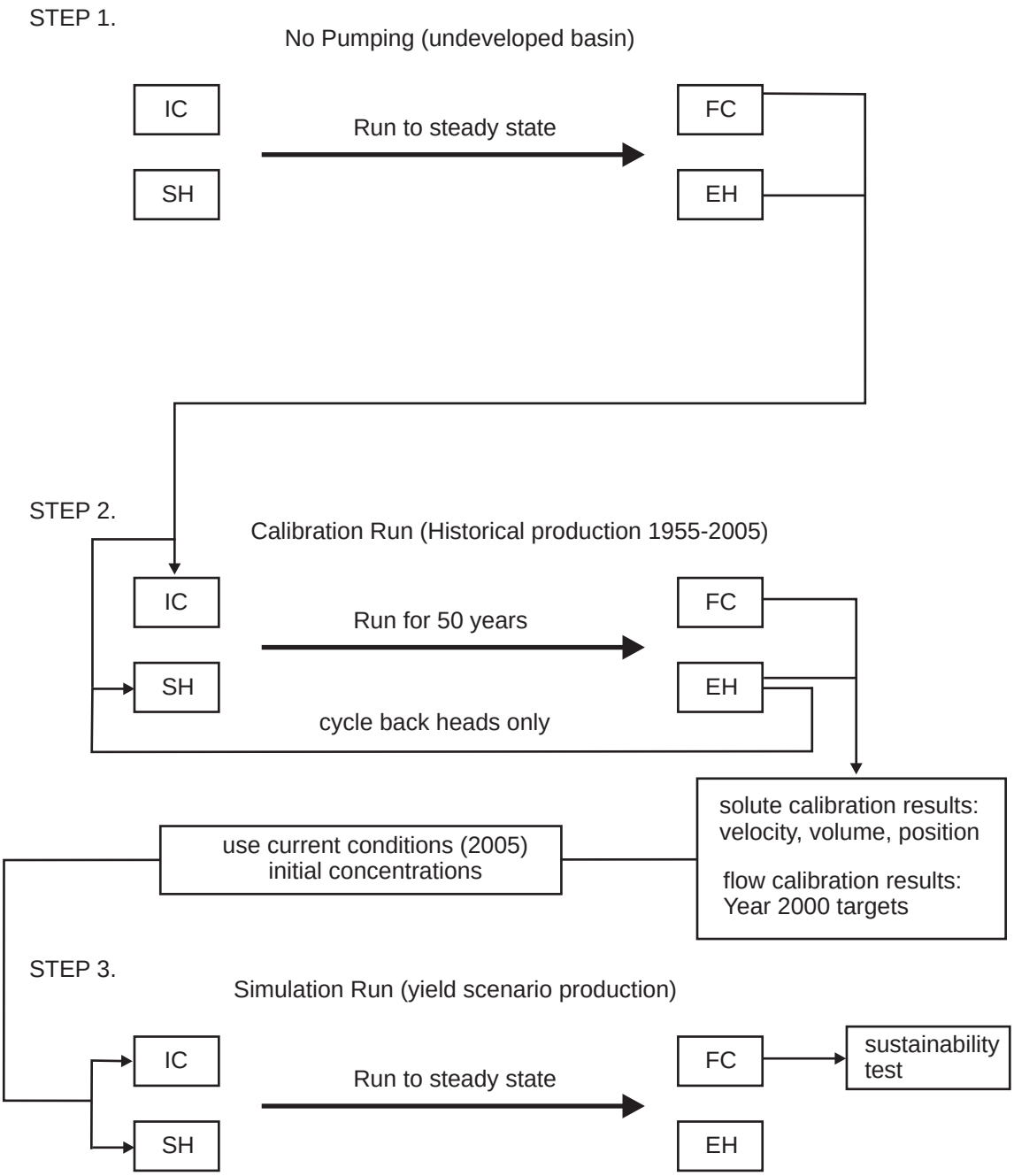
The SEAWAT model calibration consisted of two steps (Figure 1). The first step was to create initial concentrations and heads for the undeveloped basin, prior to pumping. The basin model was run with no pumping and natural recharge until there was no significant change in solute concentrations or heads (steady state).

The second step involved simulating 50 years of historical production from an undeveloped basin condition. Purveyor production was input to simulate three time periods: 25 years at early basin development (700 afy average), 20 years at year 2000 steady-state basin development (2,350 acre-feet per year average), and five years at current conditions (2,000 acre-feet per year).

The flow portion of the model remains calibrated to the steady-state head targets based on the equilibrium reached in 1999-2000. These targets were compared to the SEAWAT model heads after 45 years of pumping.

Due to the transient nature of the current model, aquifer storativity and porosity will affect the velocity of solute movement and the rate of change of head over time. A nominal storage coefficient of 0.0008 was assigned to the lower aquifer based on aquifer tests conducted by the U.S. Geological Survey in 1986, with a specific yield of 0.15 in unconfined areas of the basin. The porosity in the model ranges from 20-40 percent.

Solute transport in the basin is simulated by advection and dispersion. Diffusion is not a significant transport process in the sand and gravel aquifers. Advection was simulated using both finite-difference and total-variation diminishing (TVD) solutions, with comparable results. Flow and solute mass balance error was less than 1 percent at steady-state. Dispersion parameters were set at 100 feet longitudinal, 20 feet lateral, and 2 feet vertical. The flow calibration results, expressed in terms of the residual error statistics, are as follows:



LEGEND:

IC = Initial Concentrations
FC = Final Concentrations
SH = Starting Heads
EH = Ending Heads

Figure 1
Simulation Flow Chart
2009 SEAWAT Model

Cleath-Harris Geologists, Inc.

Table 1
Residual Error Statistics

Parameter	Original (2003)	Update (2004)	EFH (2005)	EFH (2008)	SEAWAT (2009)
Residual Mean	2.44 feet	0.03 feet	0.57 feet	0.93 feet	0.58 feet
Residual Standard Deviation	7.17 feet	5.61 feet	5.34 feet	4.66 feet	5.12 feet
Absolute Residual Mean	5.59 feet	4.42 feet	4.24 feet	3.73 feet	4.14 feet
Ratio of RSD to range	11.4%	8.9%	8.0%	7.0%	7.6%
Range in head	63 feet	63 feet	67 feet	67 feet	67 feet
Residual difference <10 feet	81%	92%	92%	95%	92%
Residual difference <20 feet	100%	100%	100%	100%	100%

Calibration of the dual-density (solute transport) portion of the model involved comparison of intrusion velocity and estimated volume of sea water intrusion at the coast with values estimated during the 2005 sea water intrusion study.

Prior work in 2005 estimated the velocity of sea water intrusion during the last 25-30 years in the lower aquifer at 50 to 60 feet per year. The SEAWAT model simulates an average velocity of 60 feet per year in the lower aquifer over the first 50 years of pumping, although the simulated velocity is higher in Zone D (80 feet/year) and lower in Zone E (40 feet per year).

After 50 years of simulated basin production, the inland position of the sea water transition zone in Zone D is relatively close to the current condition. The simulated position of Zone E is 1,000 to 2,000 feet closer to the coast than the current condition. This could be adjusted by adding more transient features to the model, such as refining historical production and recharge values. For a steady-state planning horizon, these differences do not affect long-term yield. Nevertheless, all simulations were started using initial concentrations that match 2005 conditions (Step 3; Figure 1). The volume of sea water intrusion estimated by the SEAWAT model for current conditions is 475 AFY, which is very close to the 469 AFY from the 2008 EFH model.

Urban Area Yield Update

Safe yield is historically defined as the maximum draft on a basin that will not produce undesirable impacts. In Los Osos, the primary undesirable impact is sea water intrusion. As sea water enters fresh water aquifers, chloride concentrations and associated TDS concentrations rise. The threshold

of undesirable impacts from chloride contamination is assumed to be 250 milligrams per liter (mg/l), which corresponds to the recommended maximum concentration for drinking water.

The Los Osos Valley groundwater basin has been divided, for discussion purposes, into the following areas:

West Side. The West side of the basin extends west of Palisades Avenue and includes Cuesta-by-the-Sea, Redfield Woods, the Martin Tract, Cabillo Estates, Sunset Terrace, and Monarch Grove. The division between the West side and the East side roughly corresponds to the edge of the perching clay.

East Side. The East side of the basin extends east of Palisades Avenue and includes Baywood, downtown Los Osos, Bayview Heights, Bayridge Estates, mobile home parks on Los Osos Valley Road, and all rural residential neighborhoods between South Bay Boulevard and Palomino Drive. The division between the East side and the creek valley area is defined by a change in the pattern and long-term trends of seasonal fluctuations in water levels (Cleath & Associates, 2002).

Creek Valley. The creek valley, also known as the Creek Compartment, extends from the East side, across the Los Osos Creek Valley to the east limits of the basin.

Urban Area. The urban area includes the West side and the East side.

The location and production capacity of existing or potential future purveyor wells in the Urban area provide a framework for developing the basin yield. The yield analysis consists of maximizing production while maintaining chloride concentrations at producing wells below 250 mg/l.

A steady-state planning horizon was selected. This corresponds to several thousand years of mass transport, given the large volumes of water stored in the basin aquifers. For perspective, 50-year and 500-year snapshots of simulated sea water intrusion are also presented for the current condition and VPA2b yield scenarios.

To configure the basin for yield scenarios, each existing well and potential future wells were assigned a maximum annual production cap, based on historical records, pumping tests, or anticipated yields. Production values were rounded to the closest 50-acre feet.

Current Condition Yield

The process of yield analysis begins with loading production values for a scenario into the model. Initial TDS concentrations and heads are calibrated to current conditions. Then the model is run to steady-state in 50-year stress periods over a 5000-year cycle. Model results after 50 and 500 years of simulated flow are extracted, along with the steady-state result.

A sustainability test is performed on the steady-state results. If the chlorides at a producing purveyor well exceeds 250 mg/l due to sea water intrusion, the yield is assumed to be unsustainable. Simulations are run until a sustainable yield is achieved. The optimum yield solution is reached when the difference between sustainable and unsustainable yield is reduced to approximately 50 acre-feet. Using this methodology, the updated yield for the basin under current conditions is shown below in Table 2.

Table 2
Basin Safe Yield Estimate - Current Conditions

Basin Area	Basin User	Yield (AFY)
Urban Area	Purveyor wells	2,100
	Sea Pines Golf Course	100
	Rural Residential (East side)	125
Creek Valley	Rural Residential (creek valley)	75
	Creek Valley (ag irrigation wells)	800
Basin Total		3,200

The overall basin yield estimate under current conditions (assuming no creek valley surplus water development) is 3,200 acre-feet per year. After subtracting 1,100 AFY in agricultural irrigation, private domestic use, and golf course irrigation, the purveyors have an estimated 2,100 AFY of sustainable yield. This is comparable to the current level of community demand, which has averaged approximately 2,040 AFY over the last five years (attached).

Balancing the basin, however, requires a significant redistribution of pumping between the upper and lower aquifers. These aquifers are not independent, and yield values should be interpreted accordingly. More lower aquifer yield can be obtained at the expense of upper aquifer yield, and vice-versa.

For the balanced basin simulation of current conditions listed in Table 2, the upper aquifer yield is 1,700 AFY and the lower aquifer yield is 1,500 AFY (basin-wide). The distribution of upper aquifer versus lower aquifer yield varies across the basin, however, with most of the lower aquifer yield in the East side and creek valley. For purveyor wells in the urban area, the yield distribution for a current conditions balanced basin is 1,490 AFY upper aquifer and 620 AFY lower aquifer.

One hypothetical optimum solution for urban area purveyor well production that mitigates sea water intrusion under current conditions is given below in Table 3. Figures showing seawater intrusion at 50 years, 500 years, and steady state, with chemographs for representative wells are attached. A hydrologic budget flow diagram is also attached. Note that 55 AFY of sea water intrusion continues to enter the basin, where it dilutes to below 250 mg/l chloride before reaching active production wells.

Table 3
Potential Purveyor Well Production under Current Septic Conditions

Purveyor	Well	Production (AFY)
GSWC	Upper Aquifer	740
	Lower Aquifer	310
	GSWC TOTAL	1,050
	Upper Aquifer	650
	Lower Aquifer	300
	LOCSD TOTAL	950
S&T	Upper Aquifer	100
PURVEYOR TOTAL		2,100

Note: Other optimum yield pumping distributions are possible. The actual distribution of well production would be subject to purveyor agreement.

Wastewater Project Conditions Yield

The same methodology was applied to the wastewater scenarios. Two wastewater scenarios have been simulated: Spray Field only and a VPA2b. Results of the wastewater project conditions yield simulations are shown below in Table 4.

Table 4
Basin Safe Yield Estimate - Wastewater Project Conditions

Basin Area	Basin User	Yield (AFY)	
		Spray Field Only	VPA 2b
Urban Area	Purveyor wells	1,600	2,050
	Sea Pines Golf Course	100	100
	Rural Residential (East side)	125	125
Creek Valley	Rural Residential (creek valley)	75	75
	Creek Valley (ag irrigation wells)	800	800
Basin Total		2,700	3,150

These basin yield estimates assume no creek valley surplus water development. The basin-wide upper aquifer yield is 1,320 AFY and the lower aquifer yield is 1,380 AFY for Spray Fields. For VPA2b, the basin-wide upper aquifer yield is 1,565 AFY and the lower aquifer yield is 1,585 AFY.

The purveyor well production distribution for a balanced basin, with all spray field disposal, is 1,070 AFY upper aquifer and 530 AFY lower aquifer. For VPA2b, the distribution is 1,325 upper aquifer and 725 lower aquifer.

Hypothetical optimum solutions for the urban area purveyor well production that mitigates sea water intrusion under these wastewater project scenarios is given below in Tables 5 and 6. Figures showing seawater intrusion at 50 years, 500 years (VPA2b only), and steady state, with chemographs for representative wells, are attached. A hydrologic budget flow diagram (VPA2b) is also attached. Note that 55 AFY of sea water intrusion continues to enter the basin, where it dilutes to below 250 mg/l chloride before reaching active production wells.

Table 5
Potential Purveyor Well Production under Wastewater Project Conditions with Spray Field Disposal Only

Purveyor	Well	Production (AFY)
GSWC	Upper Aquifer	485
	Lower Aquifer	265
	GSWC TOTAL	750
LOCSD	Upper Aquifer	485
	Lower Aquifer	265
	LOCSD TOTAL	750
S&T	Upper Aquifer	100
PURVEYOR TOTAL		1,600

Note: Other optimum yield pumping distributions are possible. The actual distribution of well production would be subject to purveyor agreement.

Table 6
Potential Purveyor Well Production under Wastewater Project Conditions with VPA2b Disposal

Purveyor	Well	Production (AFY)
GSWC	Upper Aquifer	740
	Lower Aquifer	310
	GSWC TOTAL	1,050
LOCSD	Upper Aquifer	485
	Lower Aquifer	415
	LOCSD TOTAL	900
S&T	Upper Aquifer	100
PURVEYOR TOTAL		2,050

Note: Other optimum yield pumping distributions are possible. The actual distribution of well production would be subject to purveyor agreement.

Sea Level Rise

The Intergovernmental Panel on Climate Change estimates sea level will rise up to two feet within the next 100 years (IPCC, 2007), although more recent analysis by the U.S. Geological Survey indicate the rise may be significantly greater (USGS, 2008). Sea level rise is attributed to thermal expansion of the ocean water and melting of land-based ice. Both of these mechanisms would result in slightly lower average sea water density and salinity.

Sea water density is controlled by pressure, temperature, and salinity. Based on the equation of state, an increase density of one part per thousand (ppt) can be brought about by:

1) a decrease of about 5° Centigrade (from 17° to 12° C at 36 ppt salinity and atmospheric pressure).
2) an increase of about 1.2 ppt salinity; and
3) an increase of about 200 decibars pressure.
(Reid, 1954)

Using the above relationship, if global warming resulted in an approximate 5° Centigrade increase in mean ocean temperature (upper range of global warming predictions), sea water density could decrease approximately 1 part per thousand, from 64 pounds per cubic foot to 63.94 pounds per

cubic foot. The density of fresh water is 62.44 pounds per cubic foot. Using the SEAWAT model and this density correction, a 2-foot sea level rise appears to decrease yield under current conditions by 50 acre-feet.

Discussion

The SEAWAT model shows a balanced basin yield under current conditions (septic systems in place) of 3,200 AFY, similar to the July 2005 LOCSD Draft Water Management Plan estimate of 3,250 AFY. There is, however, significantly less yield from the lower aquifer (with a corresponding greater upper aquifer yield) in the urban area than previously estimated.

Wastewater simulations show that exporting all of the current septic flow from the prohibition zone (1,157 AFY before conservation) will decrease basin yield by approximately 500 AFY. The decline in yield is less than the exported water because most of current septic return flows cannot be effectively captured by purveyor wells before draining to local creeks or the bay. The VPA2b simulation shows that returning 448 AFY to Broderson increases basin yield by 450 AFY.

Under any balanced basin scenario, shutting down lower aquifer production wells may significantly affect system peaking capacity, since upper aquifer wells generally do not have as high an instantaneous discharge capacity as lower aquifer wells. Planning for nitrate removal or blending is also more challenging with less lower aquifer yield.

The SEAWAT model confirms that the strategy for sea water mitigation is to shift from lower to upper aquifer production in the urban area. An ISJ basin management plan can maximize system reliability by developing new upper aquifer wells, but allowing existing lower aquifer wells to continue operating for blending or peaking until specified water quality thresholds have been reached and sufficient replacement capacity has been developed.

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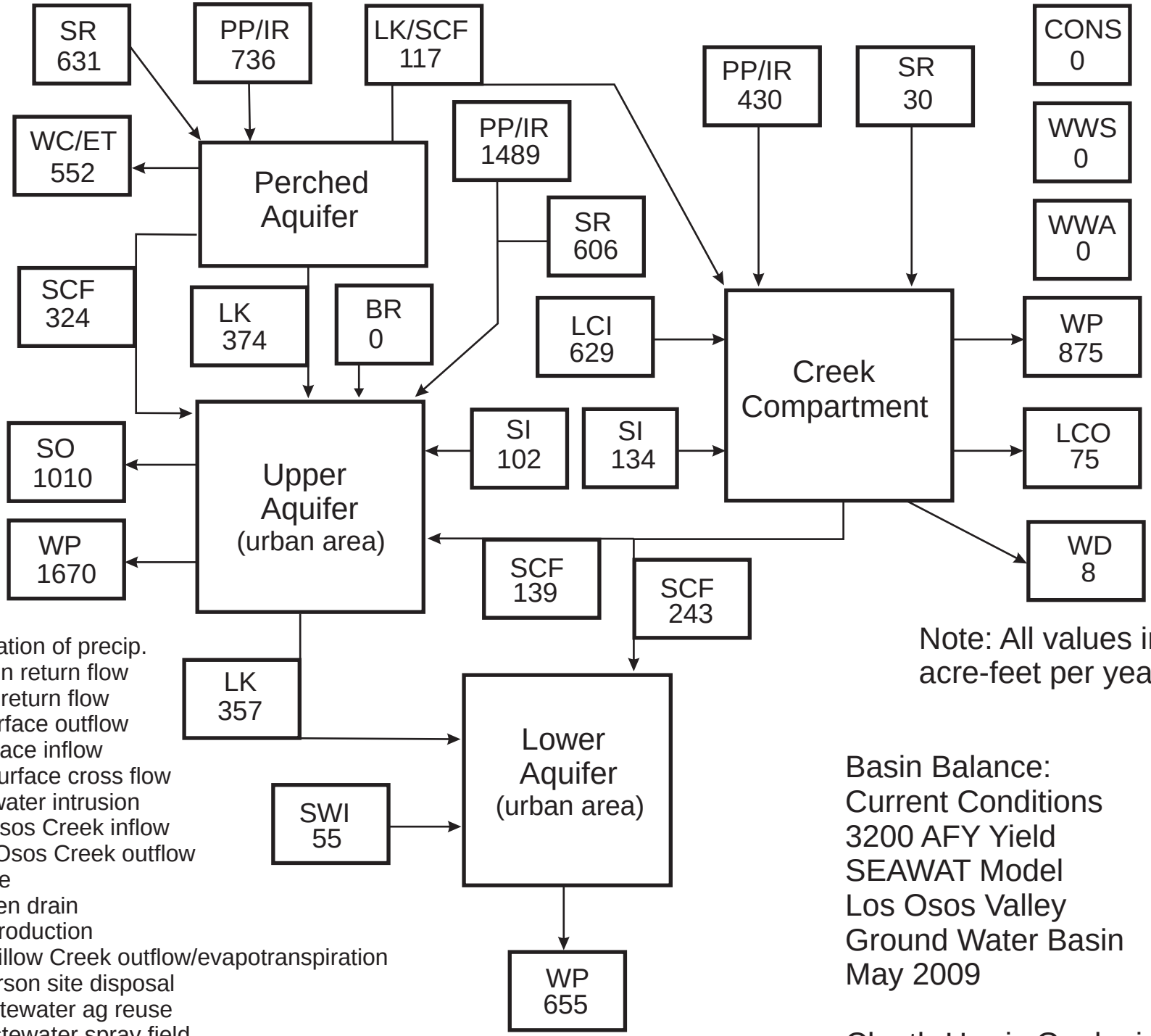
ATTACHMENTS:

Purveyor Production Records
Purveyor Wells
Hydrologic Budget Flow Diagrams
TDS Isoconcentration Maps
TDS Chemographs

Los Osos Water Purveyor
Production in acre-feet

YEAR	LOCSD	GSWC	S&T	Purveyor total
1982	817	853	99.6	1769.6
1983	791	866	100.2	1757.2
1984	1004	984	117.9	2105.9
1985	1093	1049	109.9	2251.9
1986	1172	1067	112.5	2351.5
1987	1158	1095	112.4	2365.4
1988	1259	1181	123.4	2563.4
1989	1175	1154	107.4	2436.4
1990	1161	1120	108.7	2389.7
1991	1102	1045	102.5	2249.5
1992	1157	1038	108.2	2303.2
1993	1003	1018	101.4	2122.4
1994	1113	995	95.8	2203.8
1995	1364	989	95.8	2448.8
1996	1097	1033	98.9	2228.9
1997	1190	1107	111.2	2408.2
1998	1065	994	110.1	2169.1
1999	1069	1103	61.8	2233.8
2000	1149	1076	111.5	2336.5
2001	1099	1065	98.7	2262.7
2002	1158	1061	118.7	2337.7
2003	1131	1035	96.1	2262.1
2004	1045	1072	100.3	2217.3
2005	960	1018	93.3	2071.3
2006	939	966	88.2	1993.2
2007	943	990	95.6	2028.6
2008	870	945	91.4	1906.4
2004-2008 average	951.4	998.2	93.76	2043.36



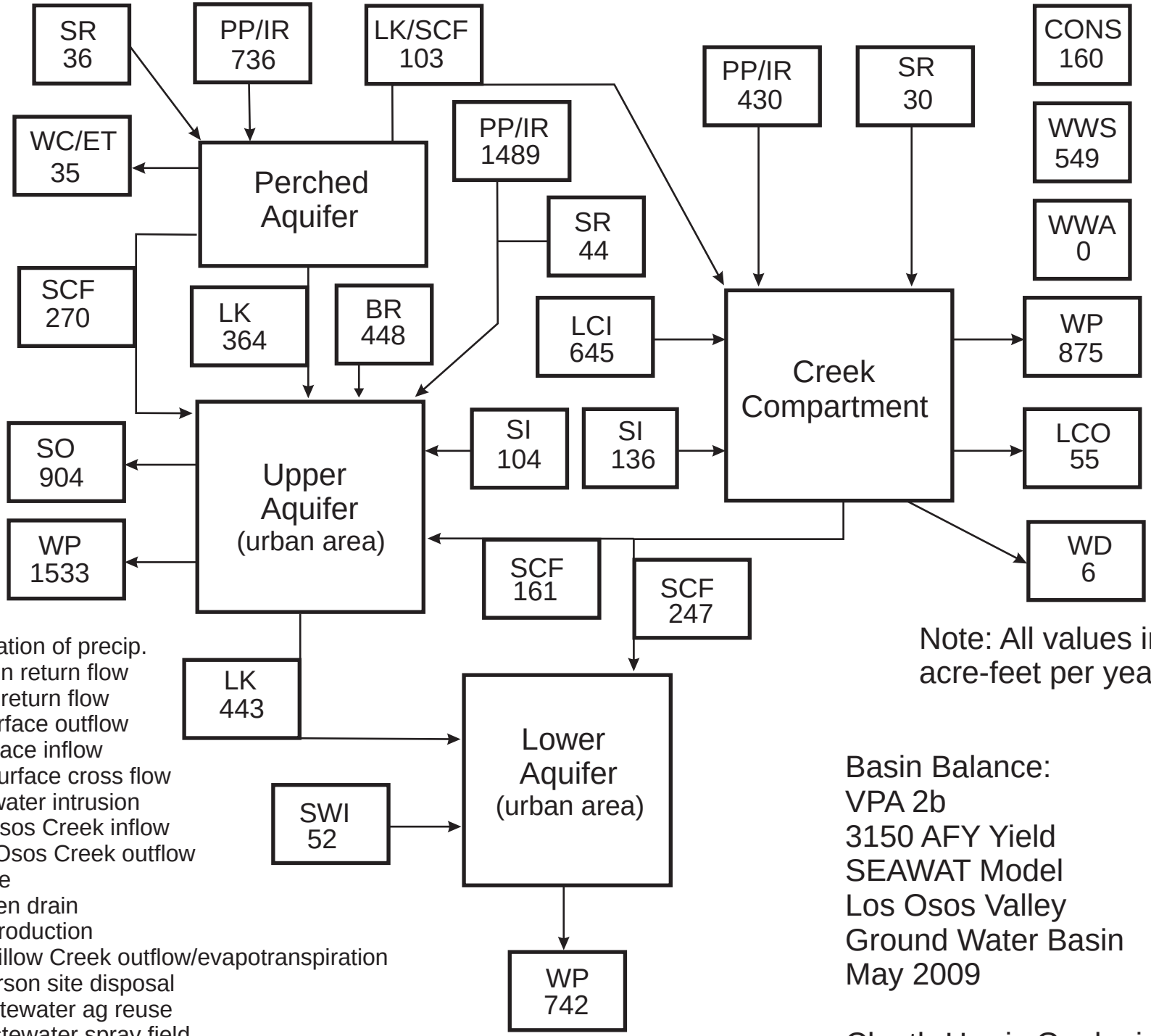
Legend

PP = percolation of precip.
IR = irrigation return flow
SR = septic return flow
SO = subsurface outflow
SI = subsurface inflow
SCF = subsurface cross flow
SWI = sea water intrusion
LCI = Los Osos Creek inflow
LCO = Los Osos Creek outflow
LK = leakage
WD = Warden drain
WP = well production
WC/ET = Willow Creek outflow/evapotranspiration
BR = Broderson site disposal
WWA = wastewater ag reuse
WWS = wastewater spray field
CONS = water conservation

Note: All values in acre-feet per year

Basin Balance:
Current Conditions
3200 AFY Yield
SEAWAT Model
Los Osos Valley
Ground Water Basin
May 2009

Cleath-Harris Geologists, Inc.



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Note: All values in acre-feet per year

Basin Balance:
VPA 2b
3150 AFY Yield
SEAWAT Model
Los Osos Valley
Ground Water Basin
May 2009

Cleath-Harris Geologists, Inc.

Memo

To: Los Osos Sustainability Group

From: Peter Mayer, P.E.

Date: October 10, 2011

Re: **Review of 2011 Water Demand Analysis and Water Conservation Evaluation prepared by Maddaus Water Management**

The Los Osos Sustainability Group (LOSG) contacted Peter Mayer of Aquacraft and requested his review of the *2011 Water Demand Analysis and Water Conservation Evaluation* prepared by Maddaus Water Management for the Los Osos ISJ Working Group. The LOSG wanted to know if the Maddaus plan maximized cost-effective conservation for the Los Osos area, and, what can be done to increase water use efficiency in Los Osos. We very much appreciate the opportunity to review this analysis and evaluation document and offer the following thoughts and comments for the LOSG.

In 2011, Aquacraft, Inc. completed a state-wide analysis of single-family home water use in California (DeOreo, 2011). This study provided detailed data on the patterns of indoor and outdoor water use homes across the State. The statistics on water use and models that were prepared for this study provide a clear picture of current, typical single family water use in California, and we have relied on these results in our analysis.

General Comments

Los Osos, California is a small community that has real concerns about the long term viability of its groundwater supply because of documented evidence of seawater intrusion into the aquifer that is relied upon for potable water. Based on documents provided to Aquacraft by the LOSG, the danger of seawater intrusion is significant and experts have recommended that Los Osos reduce groundwater pumping quickly to try and reduce further damage to the aquifer.

The evidence of seawater intrusion in the Los Osos basin is well documented. The *Los Osos Groundwater Basin Update* states, "Based on the increasing rate of seawater intrusion described, it is clear that quick and decisive action must be taken to address the intrusion" (ISJ Working Group, 2010). Dr. Douglas Smith of CSUMB notes in a June 9, 2010 letter to the California Coastal Commission, "The available chloride data from the basin (although not up to date) indicates that saltwater intrusion is quickly progressing." Eugene Yates, author of two studies on the Los Osos

Basin states, "The seawater intrusion problem is extremely urgent. Seawater intrusion moved over a half mile in four years and has reached the center of municipal pumping from the lower aquifer" (Yates 2010).

Groundwater is the sole water source for the area at this time. A concerted water conservation effort in Los Osos has been identified as the quickest and least expensive way to reduce groundwater pumping and stabilize the endangered aquifer. A strong and aggressive water conservation program appears to be of critical importance for the sustainability of the Los Osos basin.

The Los Osos Wastewater Project, Coastal Development Permit (CDP-A-3-SLO-09-055/069) issued 9/7/2010 states that "prior to construction" a water conservation program must be implemented which, "limits indoor water use to no more than 50 gallons per person per day on average within the basin," and which should, "reduce potable water use as much as possible." The CDP document also states that the Los Osos conservation program, "shall include provisions for the use of the $5 million committed by the Permittee to initiate water conservation measures pursuant to the basin plan as soon as possible following CDP approval."

With this context in mind, I have prepared the following observations and comments about the Maddaus 2011 Water Demand Analysis and Water Conservation Evaluation.

Lack of Urgency

The first thing that struck me in reviewing the Maddaus report is that there is barely any mention of the seawater intrusion issue in the entire document. There is no indication from the Maddaus plan that the water supply of Los Osos is in peril and without substantial water conservation could be severely impaired. A single sentence on page nine notes that, "The implementation of the selected conservation program is intended to be a key element in the correction of the existing groundwater basin overdraft condition that has led to seawater intrusion." There is barely a mention of seawater intrusion in the rest of the document.

The Maddaus plan is not couched in the context of the potentially devastating impacts of seawater intrusion facing Los Osos. There is a distinct lack of urgency in the tone of the Maddaus report. The plan reads like a standard consultant water conservation study for a community that wishes to reduce water use for the purpose of obtaining a desired permit and meeting long-term and development goals.

The Maddaus plan does not appear to address all of the special conditions put forward in the CDP including the provision to "reduce potable water use as much as possible" and the "provisions for the use of the $5 million committed by the Permittee to initiate water conservation measures pursuant to the basin plan as soon as possible following CDP approval."

The LOSG is very concerned about the seawater intrusion issue and had hoped the Maddaus study would maximize conservation per the Coastal Development Permit. However, the Maddaus study appears not to go beyond a 50 gpcd goal, which is less aggressive than it could be. Based on my

review, it does not appear that the Maddaus plan was prepared with the goal of reducing seawater intrusion as the over-arching theme.

Outdoor Use Under-Estimated and Not Strongly Addressed

The Maddaus conservation strategy is heavily weighted towards indoor residential use. However, it is likely that substantial additional cost-effective demand reductions could be achieved in Los Osos through expanded outdoor efficiency efforts for both residential and non-residential customers. If the Maddaus analysis had used a higher estimate of outdoor use and focused more on halting seawater intrusion, different conclusions about outdoor conservation programs might have been reached.

The minimum-month method used to estimate indoor and outdoor use in Los Osos[1] is a well-accepted standard approach, but it does tend to overestimate indoor use in warmer climates where some outdoor use occurs in every month of the year. The Maddaus study estimates residential demand to be 75% indoors and 25% outdoors. This is likely an overestimate of the indoor demand in Los Osos. It's not possible to say how large an overestimate it is with the available information, but the previous Wallace/Maddaus Urban Water Management Plan for Los Osos from 2000 estimated water use to be 54% indoor and 46% outdoor (Wallace et. al 2000). This is a substantial difference.

In the California Single Family study the data showed that on average as many households tended to under-irrigate as to over irrigate. With this in mind, the goal of an outdoor conservation program should not be to bring everyone into perfect alignment with the local evapotranspiration rate, but to reduce excess irrigation while encouraging the deficit irrigators to continue their low water use practices. By establishing water budgets for outdoor use based efficient levels of irrigation, Los Osos water providers could have strongest and quickest effect on outdoor use.

The Maddaus plan considers the following outdoor conservation measures:

- Design standards for new landscapes
- Educational workshops for residents.
- Rebates for rain sensors.
- Requirement for smart controllers and rain sensors in multi-family (a relatively small segment of customers in Los Osos)
- Turf removal (aka cash for grass)

Of these measures only rebates for rain sensors and turf removal had a benefit/cost ratio greater than 1 indicating it would be cost-effective to implement given the various assumptions. The Maddaus plan does not consider the most effective measure for reducing outdoor water use which is the creation of landscape water budgets that help both utilities and customers identify wasteful irrigation practices.

[1] In the Maddaus study, "Indoor use is based on an average of 2 lowest consecutive months in the winter if meters are read bi-monthly, or single lowest month if meters are read monthly.

The Maddaus conservation report uses an avoided cost for new water based on the Naciemento project. The report gives an annual cost for new water from the Naciemento project as follows: $400/Acre-Foot (AF) for operations, $3,000/AF for annualized capital costs for a total annual cost of $3,400/AF. At the relatively high cost of $3,400/AF for an alternative water supply, the benefit/cost ratio of a wide range of indoor and outdoor water conservation measures will be very attractive. However, this estimate must be solidified to answer key questions such as: Are all costs included? What are the environmental impacts and costs? How firm are the basic capital costs? Are there connection costs that must be borne by Los Osos? How reliable is the Naciemento project water?

Metering and Rates : Powerful Demand Management Tools

Perhaps the most startling omission from the Maddaus study is any substantive discussion of metering and rates. Charging users for the measured volume of water they use each month using a tiered, conservation-oriented water rate structure has been shown through numerous studies to be one the most effective and cost-effective ways to reduce water use.

Some properties in Los Osos are currently not metered, including properties using private wells. Full metering of ***all*** water users (including private wells) and monthly billing for all customers of water suppliers should be an immediate goal for Los Osos. The Maddaus study assumes full metering of the S&T service area (currently not metered), which is a condition for the LOWWP coastal development permit (Condition 108). However, the Maddaus plan does not recommend full metering of private wells within the URL. Full metering of private wells is essential to quantifying the total amount of water pumped within the basin, an important step in combating seawater intrusion.

The Maddaus study states that two of Los Osos' three water providers have water rate structures that "encourage conservation", but the study does not describe these rate structures or provide any analysis of the effectiveness of these specific rate designs for reducing water use and encouraging efficiency. Furthermore, the study overlooks the fact that S & T water company will apparently continue to be without any sort of a conservation-oriented rate structure after metering is implemented.

The Maddaus study does include a "Conservation Pricing Modification" measure option, but there is little discussion of this measure in the text and it is unclear how its inclusion impacts demand (if at all) in the forecasts. It appears that reducing water use through pricing mechanisms was not a major consideration in this study.

If I were designing a water conservation program for Los Osos I would place a strong emphasis on metering and rates and I would recommend that Los Osos move quickly to adopt a <u>water-budget based</u> increasing block rate structure which has been shown to be one the most effective ways to reduce water use quickly. This type of rate structure is different from a simple tiered rate structure. Traditional tiered rates go up with increasing water use regardless of household and property size. A water-budget rate structure establishes billing rates based key factors such as landscaped area and average occupancy. Water budget-based rates encourage efficient water use among all users. Good examples of water budget-based rate structures can be found in Irvine, CA, San Juan Capistrano, CA,

Boulder, CO, and Castle Rock, CO. Full metering of all water uses in the Los Osos Basin and implementation of aggressive water budget-based rate structures may require governmental action, possibly ordinances, and financial incentives to implement, but offer Los Osos maximum opportunity to reduce water demands and combat seawater intrusion.

A key element of metering is finding ways to provide water customers with real time information on their consumption via a simple and convenient display. Several low-cost devices are available on the market that allow the end users of water to track their use and be included as active participants in the water management efforts, rather than passive recipients of top-down commands.

The combination of conservative water budgets linked to a proper rate structure, which compels over users to pay the full avoided costs for excess use as well as penalties for wasteful use, can provide maximum incentive for customers to alter their use patterns with minimum costs to the public. In this system subsidies and rebates would be replaced with a pricing system that accurately reflects the true cost of water and then allows the customer to make rational economic decisions. To the extent that rebates and public expenditures are included, they could be funded from the $5 million budget discussed in the CDP and/or from revenues generated from high water users under a water budget rate structure.

Why focus on new building provisions?

In the Maddaus study, efficiency measures impacting new development comprise a third of the program offerings considered in three of four scenarios. This is further indication that the Maddaus study was not developed for the primary purpose of reducing seawater intrusion. Even when designed for optimum efficiency, new development increases overall water use. Since seawater intrusion threatens the basin water supply, wouldn't it make sense to temporarily halt new development until the intrusion problem is solved? The Maddaus plan assumes new construction will begin in 2015, one year after LOWWP implementation and before the impacts of the water conservation program and seawater intrusion mitigation efforts can be fully assessed.

Greater conservation is achievable

The LOSG asked Aquacraft to consider what level of water efficiency could be achieved with water conservation program measures and a $5 million budget. The Maddaus study aims to reduce indoor per capita use to 50 gpcd by 2018 at the earliest.

Fifty gpcd is not particularly aggressive. Aquacraft's research has shown that 40 gpcd can be achieved today through the installation of water efficient toilets, high-efficiency washers, and low flow faucet aerators. Indoor usage levels below 40 gpcd can be achieved with more efficient fixtures and a good leak detection and repair program.

The results from the California Single family study showed that indoor use of 120 gphd, which is equivalent to about 42 gpcd, is an achievable efficiency target for existing homes (DeOreo, 2011). This is equivalent to approximately 3,600 gallons per household per month, or 4.8 billing units. An effective way to set water budgets would be to base them on 42 gpcd. This combined with an appropriate outdoor budget, would provide water users an efficient monthly target to hit. It is

expected that residents in Los Osos will respond, especially if they are presented with effective social marketing messages as part of a concurrent education program and appropriate technical and financial assistance as necessary.

In order to achieve a target of 42 gpcd, the California Single Family study found that the following conditions are necessary (DeOreo, et. al. 2011):

1. Limit the average toilet flush volume to 1.28 gpf (That means old toilets must be replaced with high efficiency – HET – models)

2. Limit leakage to no more than 25 gphd in any home. (The data showed that high leakage rates in a few homes caused the bulk of the total leakage volume).

3. Limit clothes washers to an average of 20 gallons per load.

4. Reduce miscellaneous faucet use by 10%.

If these things are done, and all other use patterns remain the same then the indoor use can be reduced to about 42 gpcd.

For outdoor use, the California study indicated that that key goals for reducing outdoor use were (DeOreo, et. al. 2011):

1. Eliminate excess irrigation where it is occurring, without encouraging deficit irrigators to increase their use.

2. Change landscapes by replacing high water use plants and grass with varieties that require substantially less water.

3. Reduce irrigated areas.

4. Set water budget allocations that discourage wasteful swimming pool use.

Water use reductions beyond 42 gpcd are possible, but will require more efficient fixtures and appliances and additional reductions in faucet use and leaks. Given a budget of $5 million, it is certainly possible that with a properly designed and implemented conservation program Los Osos could achieve a level of savings below 42 gpcd.

Summary

This review was prepared at the request of the Los Osos Sustainability Group (LOSG) and members of the group provided background documents and feedback into the development of this memo.

Based on these documents, the danger of seawater intrusion is significant and experts have recommended that Los Osos reduce groundwater pumping quickly to try and reduce further damage to the aquifer. In my opinion this will require significant and aggressive water conservation

measures which go beyond those identified in the *2011 Water Demand Analysis and Water Conservation Evaluation* prepared by Maddaus Water Management for the Los Osos ISJ Working Group. The Maddaus conservation strategy does not "reduce potable water use as much as possible" as the CDP indicates. Outdoor usage is underestimated and not well addressed in the Maddaus plan and metering and water rates are not substantively discussed.

If the Los Osos community intends to rely on groundwater as the primary water source for years to come, a significant, aggressive, and well-funded water conservation strategy is recommended.

It is also recommended that Los Osos complete a thorough baseline water use analysis, similar to the program used for the California Single Family Home study. By performing detailed analyses of water use patterns from sample of homes from the service area it will be possible to determine the current indoor and outdoor use much more accurately, which can then be used to design the most rational and cost effective conservation program possible.

Sincerely,

Peter W. Mayer, P.E.

References

Coastal Development Permit (CDP-A-3-SLO-09-055/069) issued 9/7/2010 for the Los Osos Wastewater Project (LOWWP).

DeOreo, W.B. et. al. (2011) *California Single Family Home Water Use Efficiency Study*. Aquacraft, Inc. Boulder, CO, and California DWR. (Available for free download at www.aquacraft.com)

ISJ Working Group (2010) *Los Osos Groundwater Basin Update.* ISJ Working Group, Los Osos, California.

John Wallace & Assoc. and Maddaus Water Management (2000) Los Osos Community Services District Urban Water Management Plan December 2000. Los Osos Community Services District, Los Osos, CA.

Maddaus Water Management (2011) *2011 Water Demand Analysis and Water Conservation Evaluation.* Prepared for the Los Osos ISJ Working Group, Los Osos, California.

Smith, D. (2010) Letter to the Coastal Commission. Prepared by Dr. Douglas Smith, Co-Director of the CSU Monterey Bay Watershed Institute, June 9, 2010.

Yates, E. (2010) Review of the Los Osos Basin Update and Review of the Current Wastewater Project Description—Revised. Los Osos Sustainability Group (LOSG), Los Osos, CA.

June 9, 2010

California Coastal Commission
San Francisco, CA

Dear Commissioner,

Following a review of the literature describing the water resource issues in the Los Osos Valley Water Basin, I strongly support of the basin plan proposed by Keith Wimer and the Los Osos Sustainability Group.

I am a professor at the CSU Monterey Bay Division of Science and Environmental Policy. My degree is in Geological Sciences, and I have a long history of consulting and academic work in various aspects of watershed science. I currently serve on the Board of Directors for the Monterey County Water Resources Agency and as co-Director of the CSUMB Watershed Institute. My interest in the Los Osos Basin is strictly technical. Coastal communities of California are gradually running out of local water supplies. There are few models of sustainable water use in the region, so the Los Osos Valley Water Basin has the added responsibility of demonstrating best management practices for other basins to emulate. The decisions made here will be closely analyzed.

In 2009, I led a group of graduate students through an analysis of the water problems facing residents, resource managers, and water purveyors in the Los Osos Valley Water Basin (Smith et al., 2010). We thoroughly read the existing literature and found that there were basically two competing perspectives. There was the analysis provided in the Environmental Impact Report (and addenda), and an alternative analysis provided by the Los Osos Sustainability Group. This letter reiterates my strong support for the ideals and details developed by the Los Osos Sustainability Group.

There are several uncertainties in the water budget and physical elements of the aquifer system. Some uncertainties could be reduced with further fieldwork and modeling, and some must simply be accepted. Among the uncertainties are:

- Aquifer geometry
- Aquifer permeability
- Interaquifer exchange rates across aquicludes
- current position of the saltwater contamination
- Stream flows
- Current rainfall variability
- Future climate trends
- Sensitivity of groundwater modeling to variable inputs
- Values of water input and output that will lead to a sustainable clean water supply

Our analysis suggests that the plan outlined in the EIR had the following main flaws. There is little acknowledgement of real uncertainties associated with the hydrologic budget and groundwater dynamics. The model outputs are presented as precise and accurate, yet we saw no evidence of sensitivity analysis. How do the model results change with realistic variability in input parameters? The lack of sensitivity analysis shows a lack of scientific rigor in modeling methodology. We believe that the plan in the EIR attempts to maximize water extraction from the basin, rather than "optimizing" the extraction for a safe and sustainable supply. Evidence of this philosophy is trying to balance the basin by allowing a finite amount of seawater intrusion to continue. A balanced basin requires a positive freshwater flow offshore, which is generally produced from a water table (or pressure head) that is maintained above sea level. There is no margin of safety in the plan; there is no monitoring plan; and, there is no contingency plan. These are significant shortfalls, given the real uncertainties and consequences of failure.

In contrast, the Los Osos Group plan maximizes conservation strategies. The plan includes both a margin of safety and a system of long-term monitoring and adaptive management. In other words, it qualitatively acknowledges the integrated uncertainty of groundwater movement, aquifer geometry, and climate. Caution and flexibility give the plan a much higher probability of long-term success. The plan strives to avoid further saltwater intrusion, and to turn the pressure offshore to regain aquifer storage and long-term resource security. An oversight NGO and technical advisory committee would foster adaptive management via real-time monitoring of basin conditions. It is important to give the community a strong voice and power to control their water supply.

Lastly, I see grave dangers in delaying basin-balancing activities. The available chloride data from the basin (although not up to date) indicates that saltwater intrusion is quickly progressing. If groundwater extraction continues at present rates, the volume of freshwater in the basin will quickly diminish. Quick action is called for because reversing aquifer contamination is much more difficult than avoiding contamination in the first place. Balanced hydrology should be a fundamental requirement of regional planning, so I would strongly support a moratorium on new construction or water use until such additional use can be clearly justified by evidence of both ample water supply and the reversal of saltwater intrusion. We are facing the current problems because urban development preceded water supply development; it is time to let water supply catch up.

Sincerely,

Douglas Smith

Dr. Douglas Smith, Professor
Science & Environmental Policy, CSUMB

References

Smith, DP., Daniels, M., Frank, D., Holloway, R., Kowalski, B., Krone-Davis, P., Quan, S., Stanfield, E., and Young, A., 2010, Can Los Osos Valley Groundwater Basin Provide a Sustainable Water Supply?: Prepared for The Los Osos Valley Sustainability Group. The Watershed Institute, California State University Monterey Bay, Publication No. WI-2010-04, 78pp. (http://hydro.csumb.edu/Doug/html/CSUMB_660_LosOsos_100113_final.pdf).

Cc: Keith Wimer
Los Osos Sustainability

June 7, 2011

President
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Vice President
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California Department of Public Health
Drinking Water Field Operations Branch
Mr. Kurt Souza P. E.
District Sanitary Engineer
1180 Eugenia Place, Suite 200
Carpinteria, CA 93013

Subject: LOCSD Water System No. 4010016 - May 2011 Monitoring Report

Dear Mr. Souza:

Enclosed is the May 2011 monthly monitoring report for the Los Osos Community Services District Water System Number 4010016.

Monthly water quality monitoring results include iron/manganese for source water and treatment facilities and representative bacteriological and phosphate monitoring results within the distribution system. Please note the 3rd Street well is out of service at this time and we are increasing the testing for nitrates at the lower aquifer well at South Bay for trend analysis.

All samples are collected, preserved, and transported to laboratory under chain-of-custody protocol. In review of the laboratory results the District is in compliance with the water quality requirements and standards.

Should you have any questions regarding this report or require any additional information please feel free to call.

Sincerely yours,

Margaret Falkner

Margaret Falkner
Utility Systems Coordinator

Enclosures: Summary Water Quality Reports

Cc: Dan Gilmore, General Manager LOCSD
FILE

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Analysis Report for: LOS OSOS COMMUNITY SERVICES DISTRICT

PALISADES WELL 01 (PALISADES WELL)

Analysis Number	Collected Date/Time	Received Date/Time	Sampler Name	Sample Type	Reason	DHS	EDT	CHD	RB	Others	
20110502013	5/2/2011 9:50:00 AM	5/2/2011 2:59:53 PM	Diemel	GRAB	REQUIRED	☐	☑	☐	☐	Asuncion	Falkner Email

Method	Analysis Name	Result	Units	Completed Date/Analyst Name	
SM 2120 D	Apparent Color	<1	CU	5/4/2011	Zenker
SM 2320 B	Bicarbonate as CaCO3	210	mg/L	5/5/2011	Zenker
SM 3500-Ca.D	Calcium	120	mg/L	5/5/2011	Zenker
Calculation	Calculated Aggressiveness Index	12.3		5/19/2011	Dyson
Calculation	Calculated Langelier Index	0.30		5/19/2011	Dyson
SM 2320 B	Carbonate as CaCO3	0	mg/L	5/5/2011	Zenker
EPA 300.0	Chloride	398	mg/L	5/3/2011	Pang
SM 3111 B	Copper	<25	ug/L	5/10/2011	Dyson
SM 2510 B	Electrical Conductivity or Specific Conductance (Lab)	1730	umhos/cm	5/12/2011	Zenker
EPA 300.0	Fluoride, Without Predistillation	0.129	mg/L	5/3/2011	Pang
Hach test = SM4500-Cl G	Free Chlorine Residual (measured in the field)	Not Analyzed	mg/L		
SM 2320 B	Hydroxide as CaCO3	0	mg/L	5/5/2011	Zenker
SM 3113 B	Iron	14	ug/L	5/4/2011	Dyson
SM 3500-Mg E	Magnesium	100	mg/L	5/5/2011	Zenker
SM 3113 B	Manganese	<5	ug/L	5/5/2011	Dyson
SM (5540-C) Screen	Methylene Blue Active Substances	<0.10	mg/L	5/10/2011	Zenker
EPA 300.0	Nitrate and Nitrite Combined as Nitrogen	411	ug/L	5/3/2011	Pang
EPA 300.0	Nitrate as Nitrogen	411	ug/L	5/3/2011	Pang
EPA 300.0	Nitrate as NO3	1.82	mg/L	5/3/2011	Pang
EPA 300.0	Nitrite as Nitrogen	< 100	ug/L	5/3/2011	Pang
SM 4500 H+ B	pH (measured in field)	7.12			
SM 4500 H+ B	pH (measured in the lab)	7.48		5/6/2011	Pang/Zenker
SM 3111 B	Sodium	47	mg/L	5/19/2011	Dyson
EPA 300.0	Sulfate	39.6	mg/L	5/3/2011	Pang
	Temperature	21.0	°C		
SM 2150 B	Threshold Odor @ 60°C	1.0	TON	5/3/2011	Dyson/Zenker/Pang
SM 2320 B	Total Alkalinity as CaCO3	210	mg/L	5/5/2011	Zenker
SM 2540 C	Total Dissolved Solids	890	mg/L	5/12/2011	Pang
SM 2340 C	Total Hardness as CaCO3	710	mg/L	5/5/2011	Zenker
SM 2130 B	Turbidity	0.08	NTU	5/4/2011	Zenker
SM 3111 B	Zinc	<25	ug/L	5/10/2011	Dyson

Comments: Well Site 30S/11E-18L02M. Fe = 0.014 mg/L; Mn = < 0.005 mg/L

Analysis Number	Collected Date/Time	Received Date/Time	Sampler Name	Sample Type	Reason	DHS	EDT	CHD	RB	Others	
20110509019	5/9/2011 9:05:00 AM	5/9/2011 1:11:19 PM	Pall	GRAB	OPERATIONAL	☐	☐	☐	☐	Asuncion	Falkner Email

Method	Analysis Name	Result	Units	Completed Date/Analyst Name	
SM 2340 C	Total Hardness as CaCO3	720	mg/L	5/11/2011	Zenker

Comments:

PALISADES WELL 01 -TRT CL

Analysis Number	Collected Date/Time	Received Date/Time	Sampler Name	Sample Type	Reason	DHS	EDT	CHD	RB	Others	
20110516009	5/16/2011 8:00:00 AM	5/16/2011 1:50:51 PM	Diemel	GRAB	REQUIRED	☐	☐	☐	☐	Asuncion	Falkner Email

Method	Analysis Name	Result	Units	Completed Date/Analyst Name	
Hach test = SM4500-Cl G	Free Chlorine Residual (measured in the field)	0.83	mg/L		
SM 9215 B	Heterotrophic Plate Count	<1	CFU/mL	5/18/2011	Atkins
SM 4500 H+ B	pH (measured in field)	7.16			
Hach Method 8048	Reactive Phosphate as PO4 (measured in field)	0.71	mg/L		
	Temperature	17.6	°C		

Comments:

"++" after a result indicates "greater than" the value. "+" after a result indicates "greater than or equal to" the value.

LOCSD

MONTHLY WATER SALES- ACCRUAL BASIS

	Water Sales Accrual Basis		Water Sales Increase (Decrease) over Prior Year		Gallons Billed (in Millions) (see note 1)		Gallons Billed Increase (Decrease) over Prior Year		Average Sales per million gallons	
	2011-12 Note 2	2010-11	Amount	%	2011-12	2010-11	Gallons (in millions)	%	2011-12	2010-11
BUDGET	1,585,650									
July	$ 149,729	$ 161,324	$ (11,595)	-7.19%	18.950	19.463	-0.513	-2.64%	$ 7,901	$ 8,289
August	$ 151,411	$ 171,447	$ (20,036)	-11.69%	25.210	28.050	-2.840	-10.12%	$ 6,006	$ 6,112
September	$ 149,186	$ 148,921	$ 265	0.18%	19.044	19.674	-0.630	-3.20%	$ 7,834	$ 7,569
October	$ 135,356	134,769	$ 587	0.44%	16.048	26.027	-9.979	-38.34%	$ 8,434	$ 5,178
YTD 10/31/11	**$ 585,682**	**$ 616,461**	**$ (30,779)**	**-4.99%**	**79.252**	**93.214**	**-13.962**	**-14.98%**	**$ 7,390**	**$ 6,613**
November		88,903				16.179				
December		117,664				17.683				
January		102,993				12.485				
February		93,885				17.161				
March		115,968				13.109				
April		104,556				16.396				
May		166,381				14.975				
June		165,018				27.255				
Year-end Totals		**1,705,598**				**228.457**				

700 AFY

The prior year gallons in October of prior year appears not in zync with the amt billed; will have to verify with other staff.

NOTES:

1. The gallons billed each month as shown above is not strictly on calendar month since each billing spans two months.

Using YTD data may best interpret the data.

2. 2011-12 includes a CPI increase of 2.3% effective 07/01/11.

Stamped copy
attachments
1-16

December 13, 2010
San Luis Obispo County Board of Supervisors
County Government Building
San Luis Obispo, CA

Subject: Protest of proposed rates and charges ordinance and Proposition 218 assessment for APN 038-072-041, property address: 1101 14th Street, Los Osos, CA 93402

Dear Supervisors:

We are protesting the rates and charges ordinance, and the Proposition 218 assessment on our property (APN 038-072-041) per "Notice of Public Hearing On Ordinance To Impose Sewer Service Charges in the Service Area of the Los Osos Wastewater Project" sent to us in a letter dated October 28, 2010, from the County of San Luis Obispo Public Works Department. We are protesting for the following reasons:

1. **The LOWWP does not mitigate for what are sure to be devastating social and economic impacts on homeowners and businesses in Los Osos.**
   - Monthly sewer costs for single-family homeowners will average **$240** and can go to **$380** and above depending on water use.
   - Monthly sewer-water costs will average about **$260-$270** and can go to about **$410-480** and above.
   - Sewer-water costs don't include projected increases to water costs for management measures currently planned by water purveyors, which **could easily add $50 or more to average bills,** making **average bills over $300** and **bills for families of 6 or more $400-500** per month.
   - Using 2000 median household income (MHI) data, project documents show average sewer costs **exceed affordability** levels by **200-1000% percent**—hitting young families and elderly the hardest, with costs exceeding affordability by 1000% and 700% respectively.
   - **In 2000,** the median household income **(MHI)** in the prohibition zone was **$46,500,** and USDA statistics show the **MHI had dropped 3.7% between 2000 and 2008**.
   - For about **25% of families** (with incomes below $12,999) average sewer costs are over 12% of income (**6 times higher than affordability levels**) and high sewer costs are over 18%, (**9 times higher than affordability levels**).
   - **Atlanta** is cited as the having the **highest sewer-water rates**, with **$120** per month, projected to rise to **$150** per month by **2012. Los Osos water-sewer rates will most likely be ~~triple~~ (2 X's) the next highest rates in the country.**

We are sure these costs will have extreme financial hardships on our family and our friends' families. Besides us, our mother, son's family, and brother's family own homes in the prohibition zone of Los Osos. Our mother lives on a fixed income, and we soon will be on fixed incomes, along with Keith's brother and his wife, and many people we know. We are certain many families will lose there homes unless specific cost mitigations are provided, and we are sure people should not lose their homes over a sewer. We further believe there are safeguards in the law to prevent this from happening, which have not been observed or applied in this process.

The County apparently adds an inflationary factor to the MHI, in order to state that 75% of families have "moderate/high" incomes (defined as above federally established median incomes of $32,400-$40,400) (see USDA Environmental Report, p. 72, Attachment #5). However, due to the severe downturn in the economy, the percentage of families below the median is more likely to be 40-50% (see SRF Credit Review, p. 7, Attachment #8)). This means the project exceeds affordability levels for about half the community by at least three times (300%)—and, by more than 10 times (1000%) for the lowest income families.

At the Townhall Meeting on November 29, 2010, the only potential relief County officials mentioned that seemed promising was a Community Development Block Grant (CDBG). The County has not been successful in obtaining other grants (see USDA Engineering Report, p. 118). CDBG grants might provide somewhere in the neighborhood of $200,000 or so, if received. This provides only about $38 annually for each single family homeowner (or "benefit unit") and about $100-$125 annually for families below median income levels (assuming 5000 families and 25-40% are below those levels). Thus, CDBG money does virtually nothing to offset sewer costs from a low of $185 to over $400 per month for single family homeowners (see our estimates using LOWWP documents).

The combined sewer costs under various scenarios should have been provided in the ordinance notice, the Town Hall flier, and the ordinance itself for decision makers and the public to make informed decisions on this ordinance. Further, a thorough analysis of the social and economic impacts on the community and businesses must be done—with specific mitigations in place prior to approval of an ordinance (or any further development of the project)—or the project is sure to lead to a social and economic disaster.

2. **The project apparently has several significant unfunded costs that will require future rates and charges assessments, adjustments, or other funding.** These include the following:
   - **A replacement for Broderson leach fields if they fail or don't work up to standards.** The County plans to start these up slowly and monitor them. If monitoring shows they will destabilize homes, or not mitigate for seawater intrusion, the project provides no funded back up measures. Back measures would be several millions of dollars, not counting permitting, etc.
   - **A feasible means to replace 400-500 AFY of groundwater that the EIR says will stop flowing to Willow Creek, which supplies Eto Lake, Los Osos Creek (a steelhead habitat) and the estuary.** The previous project had multiple leach fields and harvest wells, not funded in this project. These would be several millions of dollars, if they are even feasible.
   - **Adequate collection system maintenance to reduce inflow and infiltration to levels that will prevent overflows to the estuary (i.e., a SSMP and measures that meet these standards).** The Fine Screen report states that this will add costs to the system, and additional O&M costs have not been included in estimates since the Fine Screening first presented them (without the augmented maintenance) (see Attachments #7 & #8).
   - **Ag exchange wells.** CDP Condition 5 and project Condition 97 say recycled water use measures will be prioritized to mitigate for seawater intrusion. Ag exchange (with a mitigation factor of .55) is needed to do this since ag inlieu has only a .01 factor. Ag exchange requires installing wells at a cost of about $1 million, according to the Fine Screening report (see Appendix A, Table 1-A).

- **Roads:** The staff report for the LOWWP Update October 2010 indicates not enough money will be in the project budget to pay for road repair once, $2 million borrowed from the general funds roads budget is reimbursed). (see Attachment #10).

3. **The project has no mechanisms to ensure future costs will be kept in check.** Once this ordinance and assessment is approved (if it is), costs could continue to escalate ad infinitum and it will be too late to turn back. Keith provided specific contracting strategies to contain costs in May, and asked for a reply but did not receive one (see Attachment #11). Further, Supervisor Gibson has said there will be no caps on costs. The Santa Ysabel project in Los Osos, a County Public Works project, is 500% over budget. Ten years later, the two-year project is only half complete. This shows the potential for catastrophic overruns unless specific measures are in place to prevent this from happening.

4. **A thorough life-cycle cost comparison of all alternatives on an equivalent cost basis has not been done, and must be done in order to select the most cost-effective option. and current cost comparisons show a consistent bias toward the most expensive collection system—a conventional gravity collection system with some sealed components.** The NWRI said a cost comparison of alternatives should be provided on an equivalency basis, but this was never done. The differences in contingency factors applied to alternatives resulted in many misleading statements that the costs of a STEP system and the proposed conventional gravity system are "substantially" the same, when they are not. We've attached a list of some of the biases in the review and a statement by Dana Ripley, the designer of a STEP system for Los Osos that a STEP project would be $50 million less (see Attachment #13). A centralized STEP and decentralized STEP/STEG system both would be much more cost-effective. A decentralized project, using cluster systems, e.g., like the Pio Lombardo, Inc., Scenario 2—see LOWWP Decentralized TM), but with measures that maximize conservation and reuse, as recommended by the Los Osos Sustainability Group (LOSG) would reduce costs, energy use, and benefits to environmental, social, and economic systems at $40 million, or so, less based on project documents (if bias assumptions are removed). This option—which has not been evaluated—would do more to protect and maintain the water supply and other resources, with much less risk to the basin, community, and finances (see LOSG Sustainable Basin Plan, Attachment #14, and "Alternative projects are more cost effective…," Attachment 15).

5. **The design-build process was abandoned for the collection system (the most costly component of the project) but it is needed for every project component to ensure the most cost effective project is selected.** Your Board and County staff indicated all components of the project would be subject to a design build process maximize competition and to keep costs as low as possible, also to resolve concerns over review bias. This would have allowed decision makers and the public see actual costs and designs to determine which was most cost-effective and desirable—but this did not happen. Based on expert statements and project documents, we believe this Board decision added $50 million to the project costs (see Attachments #13-#15).

   A design-build process should still be conducted; however, it should be conducted by the Design-Build Institute of America to maximize competition, minimize costs, and ensure fairness. Teams representing various technologies and options (including a decentralized option and pump and treat option) should be encouraged to provide whole-system solutions

that maximize benefits to the water supply, community, and local economy, at the least risk to resources. Project design criteria should be set to maximize the sustainability of resources, i.e., reduce contamination from all sources of nitrates, seawater, etc., at the lowest possible life-cycle costs (i.e., targeting community affordability levels). Contracts should include caps on costs and incentives to come in under bid amounts and completion time estimates. Other valuable options would be grant application and maintenance services.

6. **Thorough cost-benefit and risk analyses of project alternatives have not been done.** These are necessary, in light of changing basin and project conditions, to ensure the project selected does more good than harm, e.g., ensure the project does not make seawater intrusion worse). Available evidence supports that the approved project could easily do more harm than good, making the basin less sustainable and wasting a large sum of public funding in the process. This could lead to an environmental, social, and economic disaster. Thus, we do not believe the current project is worth the costs or risks.

   The tremendous unavoidable environmental and economic impacts from construction, in addition to the project's extremely serious potential environmental impacts, including its potential to cause seawater intrusion in the upper aquifer and harm habitat, per reviews by Eugene Yates and others, we've presented to the Board and other officials several times); outweigh the project's modest and uncertain benefits to the groundwater and the unsubstantiated (at best minor) benefits to the estuary.

   The DEIR does not set an objective for the project to improve estuary water or say that it will, while estuary water quality is within safe ranges and has been for years per NEP and SLOSEA reports. Furthermore, nitrates have reached equilibrium in the upper aquifer per a 2005 water quality report by Cleath-Harris and Associates. Nitrates in the upper aquifer average high drinking water standards now (10 mg/l per the EIR), and the project is estimated to reduce nitrates (the primary water quality objective of the project) by only 1.7 mg/l over 30 years. This estimate is not certain because it is based on basin modeling with uncertainties. Furthermore, purveyors are planning to treat the water for nitrates once it is pumped in the future. A "pump and treat" process is more cost effective for treating nitrates than a wastewater project. Several officials and official documents, including Supervisor Gibson and the Coastal Development Permit (CDP) for the project have said that the project is urgently needed to stop serious harm of the estuary. We have seen no evidence to support this, but we have seen evidence that the project could make seawater intrusion worse and harm habitat, in part, because the CDP defers mitigation calling for monitoring to address major potential groundwater impacts, (e.g., to the upper aquifer and to Willow Creek). Rather than defer mitigation, analyses should have been done to resolve substantial uncertainties per expert recommendations, various alternatives should have been reviewed, and specific mitigations (that ensure net benefits and maximize protection of resources) should have been required as conditions—which did not happen. As a result, it is not certain mitigation measures are adequate or even feasible to avoid net adverse impacts from the project.

   A decentralized project, we believe, provides the greatest benefits at the least cost, and simply treating the water for nitrates in lieu of a wastewater project may provide similar benefits, in conjunction with basin-wide water-use efficiency, septic system management, salt & nutrient management, and stormwater management plans. Implementing these management plans, with a decentralized project (including one that leaves some septic

systems in place within the prohibition zone, possibly in a phased approach) could provide greater water supply-quality benefits with much less impact and risk to environmental, social, and economic resources. The accelerating seawater intrusion is much more likely to destroy the basin than nitrates. A project that minimized disruption to hydrologic regimes is necessary to minimize impacts and risks, while maximizing benefits.

7. **A feasible basin plan that ensures seawater intrusion will be reversed and the basin will be a sustainable sole-source water supply for the existing community has not been developed, reviewed, and approved**. Consequently, it cannot be assumed the basin will be a sustainable water supply for the community, or a wastewater project will provide long-term benefits. The ISJ working group (the County and water purveyors) was supposed to produce a management plan to address seawater intrusion, which we have not seen. (It was first supposed to be out by January of 2010, then by December of 2010, and now by spring of 2011.) Also, purveyors have control over only two-thirds of the water pumped in the basin, so the plan cannot not effectively address seawater intrusion because private well use must also be managed. The LOSG recommended that the County implement a basin-wide plan, in conjunction with the Regional Water Board, per LCP Watershed Policy 5, but supervisors declined to do so and the Coastal Commission did not require it. A plan and ordinance that sets the specific objective of reversing sweater intrusion within a few years, emphasizing water-use efficiency, is essential to sustaining the basin and ensuring any wastewater project is worth the money spent. Also, the potential costs of a purveyor basin management plan, and a County plan and ordinance (if implemented) must be factored in to analyses of project's social and economic impacts to determine alternative feasibility and appropriate mitigations. Eugene Yates supports further analysis and consideration of a wider range of options, given changes in basin and project conditions (see Yates reviews previously submitted). This has not been done.

8. **The lack of adequate information (as cited above), unresolved questions about project impacts (adverse and beneficial), inadequate analysis and no mitigations for social and economic impacts, inadequate review of alternatives to determine whether the project will do more good than harm and the most cost-effective, least risky options—also the fact citizens have been threatened with Water Board enforcement action if a project is delayed—all make the rates and charges assessment ordinance invalid.** Citizens cannot be expected to make decisions in their best interests under these circumstances.

We protest this ordinance and assessment, and request that you require the above analyses and processes to identify the most cost-effective project, which maximizes benefits while minimizing impacts and risks to environmental, social, and economic resources—ensuring scarce public funding is well spent.

Sincerely,

Keith Wimer
1101 14th Street, Los Osos, CA 93402

Attachments #1-#16 (30 pages)

RECEIVED
JULIE L. RODEWALD
COUNTY CLERK-RECORDER.
DEC 14 2010
BY _____
DEPUTY

Letter of Protest

SLO County Clerk/Recorders Office
1055 Monterey St. Suite D120
San Luis Obispo, CA 93408

I protest the San Luis Obispo County proposed Ordinance to impose Sewer Service Charges for the Los Osos Wastewater Project.

Property Owner Name Elizabeth L Winner

Address 1101 14th St Los Osos CA 93402

APN # 038,072,041

X Elizabeth L Winner Date 12/8/10
Signature of Property Owner

RECEIVED
JULIE L. RODEWALD
COUNTY CLERK-RECORDER

DEC 14 2010

BY _____
DEPUTY

#1 JR

Monthly Sewer and Sewer-Water Cost Estimates for Single-Family Homeowners

(Prepared by Keith Wimer using current water rates and LOWWP documents—see attached.)

	1st 218	Rts & Chrgs Ord/218	On-lot	Tot. Sewer	Tot. Sewer-Water
Low Water Use & Low On-lot Costs	$105	$63.93	$14.76	**$184**	**$ 202 -211**
Avg. Water Use & Avg. On-lot Costs	$105	$86.55	$ 48.36	**$240**	**$261-272**
High Water Use & Avg. On-lot Costs	$105	$139 and up	$48.36	**$292**	**$323-354**
High Water Use & High On-lot Costs	$105	$139 and up	$132.00	**$376**	**$407-438**

Notes:

1. Low Water Use assumes a one-person household using 50 gpcd (2 units) with on-lot costs of $1500. The range represents LOCSD costs vs. Golden State Water Co. costs.
2. Average Water Use assumes a 2.5-person household using 50 gpcd (5 units) and on-lot costs of $3,650, the average on-lot costs per the SRF Credit Application (p. 23—see attached)
3. High Water Use assumes a 6-person household using 50 gpcd (12 units) with on-lot costs of $10,000. **Water costs can be much higher depending on use, leakage, etc.**
4. Finance costs for low and high on-lot costs ($1500 and $10,000) are calculated as a percentage of finance costs for average on-lot costs, per the SRF Credit Application, p. 23—see attached).
5. **Eláine Watson contacted several contractors regarding on-lot costs, and everyone of them said costs would be substantially higher than County estimates.**
6. Total average capital costs (first and second columns of "average water use") are slightly lower than County estimates of ($191. 55 vs. $194) million, likely because a higher average household factor (e.g., 2.6 to 2.7) was used. Therefore, these calculations are conservative.
7. **Purveyors are currently developing a management plan to address seawater intrusion <u>that will raise water costs significantly</u>.**
8. **These estimates do not calculate potential reductions with undeveloped property owners contributing to sewer costs, for two reasons: 1) the serious seawater intrusion problem makes future development unlikely, and 2) undeveloped property owners are likely to pay sewer costs as development fees, so additional project funding will be spread out over many years. Any potential reduction in existing homeowner costs will most likely be offset by increasing sewer and water costs.**
9. Atlanta is widely cited as having the highest average sewer-water costs. Currently, Atlantans' average sewer-water bill is $120.82, expected to go up to $151.92 by 2012. By 2014, Los Osos water-sewer rates will easily be double Atlanta's rates and may be more than triple. (For Atlanta rates see "Atlanta water, sewer rates among the nation's highest" in the Atlanta Journal-Constitution, by searching "highest sewer rates" or going to http://www.ajc.com/news/atlanta/atlanta-water-sewer-rates-154647.html.

LOWWP Flier 11/2010

#2 (p. 1 of 2)

Project Costs and Financing

Project Cost Estimates

The Project – which includes collection, treatment and treated effluent disposal – is estimated to cost $166M. Private property "on-lot" costs are additional and will be different for each property owner depending on existing septic systems and landscaping

The Project will be financed largely through low interest loans provided by public agencies such as the USDA and the State Water Board. We continue to pursue additional grants to reduce the level of borrowing.

To date, we have received commitments for a $83M loan and $4M grant from the USDA. This loan will be repaid over 40 years at an interest rate of 3.25%.

We have applied for the balance of financing through the State Revolving Fund (SRF) program of the State Water Board. SRF loan terms will be finalized once the service charge ordinance has been established. We are also pursuing other grant opportunities through the State Water Board program and other avenues, such as Integrated Regional Water Management (IRWM) grants administered by the California Department of Water Resources.

The loans will be repaid with two sources of revenue collected from properties connected to the Project – **property assessments** and **service charges**.

Property Assessments

In 2007, owners of **developed properties** approved total assessments of $127M for construction of the Project. Owners can pay their assessment in a lump some (and a few already have). Most property owners will pay over time as part of their property tax bills, and we currently estimate that a single family home assessment will cost about $1,260 per year (equivalent to $105/month).

Undeveloped properties were not assessed in 2007, because their ability to develop and connect to the Project was not assured due to existing water and habitat issues. The County continues to work to resolve these issues. Existing Project strategies adopted by the Board of Supervisors includes establishing a $27M assessment (or equivalent connection fees) for vacant parcels before the Project is completed in 2014. When new development is possible, **vacant properties will pay their share of Project costs before development occurs.** The County efforts to pursue assessments on undeveloped properties is a costs sharing strategy to "mitigate affordability issues" (per AB 2701)

Service Charges

Wastewater service charges will cover the loan repayments (also called unsecured debt) not covered by property assessments. Service charges will also include an amount necessary to pay for the operation, maintenance and repair of Project facilities, including normal administrative and other costs.

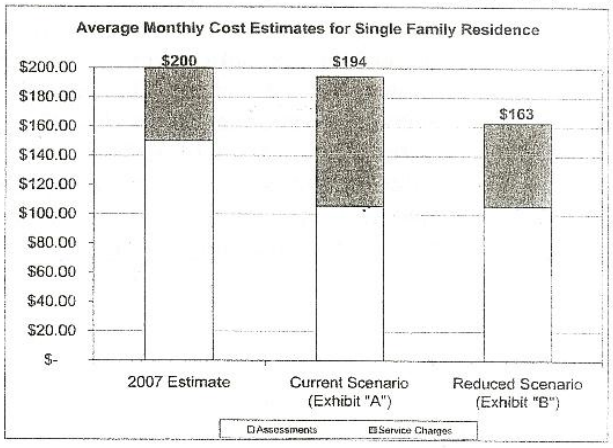
Total Monthly Cost

Avg. cost

*This does not include on-lot costs.

The total wastewater system cost (assessments plus service charges) is shown in the bar graph. In 2007, we estimated that the average total household cost ~~would~~ be $200/month. Under the "current scenario" assumptions, we now estimate the average cost to be $194/month. When vacant properties are assessed, service charges will automatically drop and the "reduced scenario" average cost will be $163/month.

We should note that existing multi-family and mobile homes will have significantly lower costs than single family homes. For example, mobile homes would have total costs less than $100/month under either scenario.



LOWWP Flier 11/2010 #2 (p.2 of 2)

Rates and Charges ("Service Charges")

The Service Charges Ordinance

The proposed service charges include a flat rate (minimum charge) and a variable portion based on the indoor water usage of each residence (which creates wastewater flows). The flat rate amount is related to construction loan repayment and the variable portion is related to operating costs. The variable component will allow residents who conserve water to reduce their service bills.

There are two rate structures in the service charges ordinance, listed as Exhibits "A" and "B."

- Exhibit "A" shows the initial rates needed to meet funding requirements under the current scenario.
- Exhibit "B" shows an automatic rate reduction that would occur when the Board of Supervisors has directed the collection of assessments or connection fees from undeveloped properties.
- **No service charges will actually be collected before the Project is operating in 2014.**

Service Charges Facts

- The California State Constitution specifies the procedures for approving an ordinance to establish the wastewater system service charges (Article XIII D, Prop. 218).
- Funding agencies require the adoption of the service charges ordinance now, before they will approve final funding.
- **State law does not allow the collection of service charges until the Project is operating; no sooner than 2014.**
- Establishing assessments or connection fees for undeveloped properties will trigger the automatic reduction in service charges.

Protests

Property owners who are subject to the service charges and wish to protest the charges may mail or deliver their written protests to the County at County Clerk/Recorder's Office, Attn: Clerk of the Board, 1055 Monterey St. Suite D120, San Luis Obispo, CA 93408 in a manner that ensures receipt by the County no later than the close of the public hearing on December 14, 2010. Property owners may also present or withdraw written protests at the hearing on December 14, 2010. The formal legal notice was mailed on October 29, 2010 and can be found on the Project website.

Minimum rate; assumes 50 gpcd

Wastewater Service Charges (Monthly Equivalent)

Exhibit "A" Rates

Monthly Usage (Units)	Typical Occupants	Single Family	Multi Family	Mobile Home	Non-residential
0 (Min. Charge)		$48.85	$36.64	$24.44	$61.13
2	1	$63.93	$51.72	$39.52	$76.21
4	2	$79.01	$66.80	$54.60	$91.29
6	3	$94.09	$81.88	$69.68	$106.37
8	4	$109.17	$96.96	$84.76	$121.45
10	5	$124.25	$112.04	$99.84	$136.53
12	6	$139.33	$127.12	$114.92	$151.61

Not the maximum rate

Exhibit "B" Rates

Monthly Usage (Units)	Typical Occupants	Single Family	Multi Family	Mobile Home	Non-residential
0 (Min. Charge)		$17.19	$12.90	$8.60	$21.51
2	1	$32.27	$27.98	$23.68	$36.59
4	2	$47.35	$43.06	$38.76	$51.67
6	3	$62.43	$58.14	$53.84	$66.75
8	4	$77.51	$73.22	$68.92	$81.83
10	5	$92.59	$88.30	$84.00	$96.91
12	6	$107.67	$103.38	$99.08	$111.99

Note: one (1) unit = 748 gallons

#4 (p. 1 of 2)

CHAPTER 8: CONCLUSIONS AND RECOMMENDATIONS

8.1. RECOMMENDATIONS FOR ADDRESSING AFFORDABILITY CHALLENGES

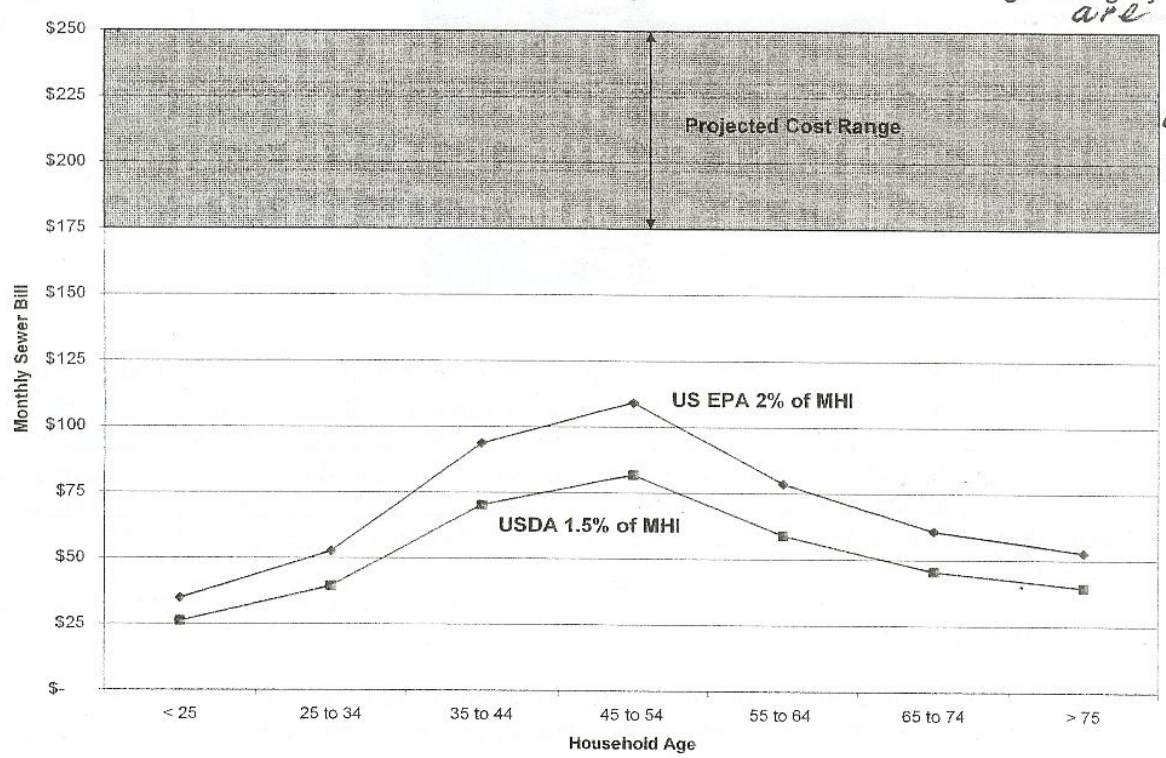
Project affordability has been a major challenge for the project since planning efforts began in 1983, following the Regional Water Quality Control Board's mandate to cease septic tank discharges in the majority of Los Osos. The lack of existing wastewater infrastructure requires that the community construct all of the necessary facilities for collection, treatment, and effluent reuse or disposal at one time. The large capital expenditure, plus ongoing operational costs and individual on-lot connection costs result in a total project cost that far exceeds any affordability standard in the moderate income community of Los Osos.

Financing — Adjusted to about $240 under current scenario.

The County has evaluated project affordability as part of its overall project planning and feasibility review. Without financial assistance, the total project costs are projected to exceed $250 per month for a typical, single family residence, which is more than 6% of the median household income (MHI) on an annual basis. The costs will be especially challenging for Los Osos where 33% of households receive Social Security income (50% higher than the statewide average), an indicator of fixed-income retirees. *

Could be higher currently because median incomes are likely to have dropped (see ERS/USDA data attached)

Figure 8.1. Los Osos Affordability Thresholds by 2000 Census Household Age Category

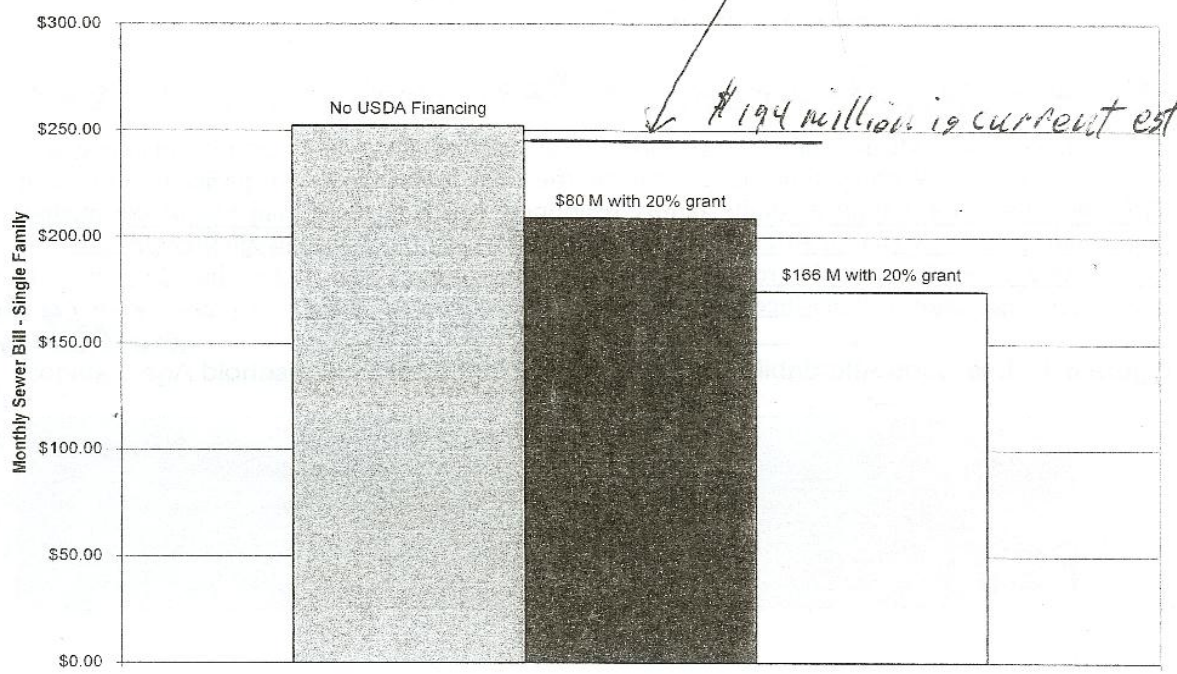


#4 (p.2 of 2)

The overall affordability impact of the project can be greatly reduced with favorable financing from the USDA Rural Development Program. USDA financing of $80 million, that includes a 20% grant component, will reduce the estimated costs for a typical single family residence by approximately $43 per month. A project that is fully funded by the USDA, including a 20% grant component, would reduce costs by an estimated $77 per month. This is more than a 30% savings over the estimated project costs without financial assistance and a substantial benefit to the community.

4.5% grant for $4 million was provided, not $16 million

Figure 8.2 Benefits of Favorable USDA Financing



$194 million is current estimate

Mitigating project affordability impacts with USDA financing is only a first step in addressing the challenge. The County is also seeking financial assistance from several other sources, including extended term loans from the State Revolving Fund program, federal grants from the Water Resources Development Act, and state grants from the Proposition 50 and 84 Integrated Regional Water Management funds. Finally, the County is seeking to implement a financial assistance program for disadvantaged individuals in the community who are unable to afford the project costs.

these have not materialized

Collection System Contracting

Construction contracting is the major capital cost of the project and it may be possible to realize significant savings over the current estimates. The current economic downturn has severely affected the California construction industry resulting in a highly competitive bidding climate.

#5 JR

CCC. On January 16, 2010, [sic] the Commission determined that a substantial issue was raised by the appeal. Consequently, the final determination of the project's consistency with the California Coastal Management Program will not occur until the Commission takes further action on the CDP. Nevertheless, for purposes of related federal consistency review of the federal agency (USDA) continuing to fund the project, we have determined that the funding decision may appropriately be separated from and may precede the final CDP action, and that the ultimate CDP action will fully address any issues raised over the project's protection of coastal resources and consistency with the CCMP"

The project is considered consistent with the California Coastal Management Program for federal funding purposes and the Commission's final decision on the CDP will, by definition, confirm this finding.

3.8 Socio-Economic Issues/Environmental Justice

This section addresses any potential socio-economic and environmental justice concerns by describing the affected environment, environmental consequences and any potential mitigation measures that may be necessary to avoid or minimize any effects caused by the LOWWP. The completed form RECD 2006-38, "Civil Rights Impact Analysis Certification" is attached in Appendix C, C-109.

3.8.1 Affected Environment

This section addresses affected environmental resources associated with socio-economic issues and environmental justice.

3.8.1.1 Socio-Economic Issues

If median and below is defined a "low" 40%-50% of Los Osos families would fall into "low" category (see p. 7 SRF Credit Review attached).

According to 2007 demographic data for Los Osos, 14,635 residents live within the Community of Los Osos. Income levels based on Federal Housing and Urban Development Department standards are defined as: very low income (up to $20,200), lower income (from $20,200 to $32,300), median income (from $32,400 to $40,400), and moderate income ($40,500 to $48,500). Minority individuals are considered members of those races that are non-white. Table 3.8-1 shows the demographic data for the community. As shown, households with low incomes represent 24.6 percent of the community, while minority populations represent 15.6 percent of the community.

Table 3.8-1 Demographic Information for the Community of Los Osos.

Income		Race	
Low	Moderate/High	White	Minority
24.6%	75.4%	88.4%	15.6%

Note:
3.5 mile radius encompassing and centered on the residential component of the community, based on County of San Luis Obispo Interactive GIS Mapping 2007

? (see note)

#6

USDA United States Department of Agriculture
Economic Research Service
The Economics of Food, Farming, Natural Resources, and Rural America

Briefing Rooms

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- Research & Productivity
- Rural Economy
- Trade & International Markets

Rural Income, Poverty, and Welfare: Income and Nonfarm Earnings

Median household income fell significantly in both rural and urban areas between 2007 and 2008, reflecting the effects of the national economic recession that started in December 2007. After adjusting for inflation, the money income of the typical nonmetro household fell by 3.3 percent, compared to a 3.7-percent drop in metro areas. In nonmetro areas, median household income in 2008 was about the same as it had been in 2000, while in metro areas it has fallen to about $4,000 below its 2000 level. Median household income in nonmetro areas now stands at 78.7 percent of the metro median, although the generally lower cost of living in rural areas may narrow this gap in real terms.

Median incomes dropped since 2000.

Total per capita income in 2008—including all cash income as well as the cash value of in-kind public assistance benefits such as food stamps and medical services—is likewise lower for nonmetro than metro residents. However, nonmetro residents receive more transfer payments (see also the chapter on transfer payments), in large part reflecting the higher Medicare and Medicaid expenses associated with an older population.

Household money income by residence, 2000-08 (2008 dollars)

Year	Nonmetro		Metro		Nonmetro as percentage of metro (%)
	Median household income ($)	Change from previous year (%)	Median household income ($)	Change from previous year (%)	
2008	40,785	-3.3*	51,853	-3.7	78.7
2007	42,176	3.1	53,823	-0.4	78.4
2006	40,892	-1.3	54,052	1.1	75.7
2005	41,429	NA	53,462	NA	77.5
2004	NA	NA	NA	NA	NA
2003	41,105	-0.9	53,921	-0.5	76.2
2002	41,498	1.6	54,195	-1.5	76.6
2001	40,864	0.7	54,993	-1.6	74.3
2000	41,145	NA	55,873	NA	73.6

*Indicates a statistically significant change in median income, at the 90-percent confidence level.
NA = Not available.
Note: Estimates for 2004 are not available because the definition of metropolitan areas changed during the course of that year. The post-2004 estimates reflect the new metro/nonmetro definitions.
Source: Calculated by ERS using data from the Annual Social and Economic Supplement (ASEC) to the Current Population Survey, U.S. Census Bureau.

Sources of per capita income, 2008

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The environmental and economic consequences of energy consumption will be given special consideration to develop projects where they are minimized. In Addition, options for individual homeowners to help mitigate the environmental and economic impact of the wastewater project include gray water systems, rain water catchment in existing septic tanks, water conserving landscape, and solar power to offset additional energy consumption.

1.3 FLOW PROJECTIONS

Estimates of the projected wastewater flows and loads were outlined in the Rough Screening Report. The load estimates have not changed, but the flows estimates have been further reviewed in this report due to increased estimates of Inflow/Infiltration. The estimate for the dry weather flow at buildout without conservation remains at 1.2 MGD.

Inflow/infiltration (I/I) estimates for the collection system alternatives were the main source of uncertainty in calculating the future treatment facility influent flow volume. If a STEP/STEG collection system is selected it is anticipated that there will be minimal I/I since the system is sealed and under pressure. If a gravity collection system is selected, only a system that was constructed of fusion-welded PVC piping could be operated with as little I/I as a STEP/STEG system. However, fusion welded PVC sewers are a new technology with little long-term operating history, and can be significantly more costly to install than traditional bell-and-spigot gravity sewers.

Properly installed bell-and-spigot sewers will be watertight at first, and then slowly lose their integrity as the surrounding soils shift, compressing the pipes, and compromising their seals at the joints. The water-tightness of a bell-and-spigot sewer can be preserved if a maintenance program is conducted on an ongoing basis to detect and repair leaks. This program would add to the cost of a gravity sewer compared to a STEP/STEG sewer with similar levels of I/I.

Attempting to keep leaks to very low levels, especially over time, is very costly.

As discussed in the Rough Screening Report, previous studies used standard collection system textbook models[1] to estimate the I/I per mile per inch diameter of pipe of gravity sewer. The total predicted I/I of the system was divided by the estimated population in order to calculate the projected I/I per capita. During wet weather, a conservative estimate for a conventional system I/I of 17 gpcd was given, which corresponded to a total potential wet weather flow of 1.5 MGD for Los Osos. However, it was pointed out that the true value would probably be much lower due to the sandy soils in the region that tend to direct water past a pipe and trench, and due to the presumed water-tightness of a new collection system. Using the textbook models, Montgomery Watson Americas, Inc., anticipated that

[1] From *Wastewater Engineering, Collection and Pumping of Wastewater*, Metcalf and Eddy (1981), and *Gravity Sanitary Sewer Design and Construction*, American Society of Civil Engineers (1982).

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3.2.3 O&M Cost

3.2.3.1 Gravity Collection System

Table 3.19 shows the estimated O&M costs for a gravity collection system. The estimated O&M includes labor, power, and equipment maintenance. The Basis of Cost Evaluation Technical Memorandum is included in Appendix C.

Table 3.19 Estimated O&M Costs for Gravity Collection System Los Osos Wastewater Project Development San Luis Obispo County

Item	Units	Quantity	Unit Price ($)	Annual O&M ($)
Labor	Hrs/year	4,160[1]	40[2]	170,000
Power	Kwh/year	500,000[3]	0.12[2]	60,000
Equipment Maintenance/Replacement	%/year	2	Pump Station Power Facility and Misc Facility Requirements Construction Cost	250,000
TOTAL O&M COST[4]				$480,000

2007 estimate

Notes:
(1) Based on 2 full-time employees and 2,080 hours per year.
(2) From Basis of Cost Evaluation Technical Memorandum.
(3) Based on energy required to convey 1.4 mgd to an out-of-town treatment facility.
(4) Septic hauling costs for homes outside of the Prohibition Zone are not included.

3.2.3.2 STEP/STEG Collection System

Table 3.20 shows the estimated O&M costs for a STEP collection system.

3.3 ENVIRONMENTAL/PERMITTING CONSIDERATIONS

Collection system analysis is for two types; conventional gravity and STEP/STEG. Both collection systems include over 45 miles of pipelines in most streets and approximately 5,000 lateral lines to collected properties. Gravity also includes pump/lift stations, and power standby facilities. Both systems require abandonment of existing septic systems. STEP/STEG includes installation of new septic systems at each collected property. The environmental issues are divided between the two systems.

3.3.1 Gravity Collection System Considerations

- Roadway disruptions during construction for up to two weeks for each block requiring sewer mains. Traffic is rerouted and access to individual homes is constrained. Careful noticing will be required.

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1.2. OPERATIONS AND MAINTENANCE (O&M) COSTS

2010

The following tables show estimated O&M costs for labor, power, and equipment maintenance/replacement. Total project O&M costs are summarized in Table 1.7. Additional reserves for capital replacement costs for short-lived assets (15 years or less) are estimated at $200,000 per year. Details of short-lived asset replacement costs are provided as Attachment A-Item 1. The cost basis for the collection system was developed in the Fine Screening Report.

Table 1.2 Estimated Annual O&M Costs for Gravity Collection System

Item	Units	Quantity	Unit Price ($)	Annual O&M ($)
Labor	Hrs/year	4,160(1)	40(2)	170,000
Power	Kwh/year	500,000(3)	0.12(2)	60,000
Equipment Maintenance/Replacement				200,000
TOTAL O&M COST(4)				**$430,000**

Notes:
(1) Based on 2 full-time employees and 2,080 hours per year.
(2) From Basis of Cost Evaluation Technical Memorandum.
(3) Based on energy required to convey 1.4 mgd to an out-of-town treatment facility.
(4) Septic hauling costs for homes outside of the Prohibition Zone are not included.

This should have increased w/ maintenance designed to reduce leaks to very low levels, and it will increase over time — thus, it appears to be under-funded.

Annual O&M costs for each of the treatment alternatives were developed in the Fine Screening Report and estimated for the following categories based on BioTran© modeling of unit process requirements.

- Labor
- Power
- Maintenance/ Equipment Replacement
- Allowances—Includes chemicals and screenings and grit disposal where applicable
- Unit cost curves for tertiary treatment per MGD

Table 1.3 Estimated Annual O&M Costs for Treatment Process

Item	Units	Quantity	Unit Price ($)	Annual O&M ($)
Labor	Hrs/year	5,200	60(1)	310,000
Power	Kwh/year	900,000	0.12(2)	110,000
Equipment Maintenance/Replacement				75,000
Allowances				50,000
Tertiary Filter O&M				100,000
TOTAL O&M COST				**$645,000**

Notes:
(1) Labor costs are based on an average $60 hourly rate, including direct and indirect costs.
(2) Power costs based on $0.12 per kWh electrical rate.

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ITEM 3: Median Household Income (MHI) for the Project Service Area

3.1. ECONOMIC DEMOGRAPHICS

The community of Los Osos is a predominantly residential community of 14,251 residents (U.S. Census 2000) located along the central Coast of California on the southern edge of Morro Bay in San Luis Obispo County. It is combined with Baywood Park to form the Census designated place of Baywood-Los Osos. There is a small business district concentrated over just a few blocks along Los Osos Valley Road on the southeast side of the town, with several additional shops servicing the Baywood section of Los Osos. The remaining sections of town are almost entirely residential. There is no heavy or light industry within Los Osos.

Employment status for the active members of the labor force is provided in Table 3.1. In Year 1999, there were 11,538 residents aged 16 years or older; 7,250 (68%) of which were active within the labor force.

Table 3.2 provides statistical data on Year 1999 income per household within the community of Los Osos. Median household income is shown as **$46,558**. A total of 190 families and 1,205 individuals were living below the poverty level in Year 1999.

Likely to be more

Table 3.1 Employment Status – Los Osos, CA[1]

Occupation	Number	Percent
Management, professional, and related occupations	2,660	38.4
Service Occupations	1,258	18.2
Sales and office occupations	1,657	23.9
Farming, fishing, and forestry occupations	73	1.1
Construction, extraction, and maintenance occupations	654	9.4
Production, transportation, and material moving occupations	629	9.1
Armed Forces	28	0.2
Unemployed	291	2.5
Total	**7,250**	**68**

[1] U.S. Bureau of the Census, Census 2000

If incomes below the MHI are defined as "low", 40-50% are in the "low" category (see USDA environmental report, p. 12 attached)

Table 3.2 Household Income – Los Osos, CA[1]

Income Range	Number	Percent
Households	5,908	100
Less than $10,000	296	5.0
$10,000 to $14,999	322	5.5
$15,000 to $24,999	793	13.4
$25,000 to $34,999	791	13.4
$35,000 to $49,999	914	15.5
$50,000 to $74,999	1,269	21.5
$75,000 to $99,999	792	13.4
$100,000 to $149,000	484	8.2
$150,000 to $199,999	100	1.7
$200,000 or more	147	2.5
Median Household Income	**$46,558**	--

[1] U.S. Bureau of the Census, Census 2000

Likely to be less (see ERS/USDA data report for 2008 attached).

LOWWP Rates and Charges Ordinance #9 JR

in the same manner and at the same time as ordinary County ad valorem taxes are collected as specifically set forth in Health and Safety Code section 5473 and Chapter 3.22 of the San Luis Obispo County Code, and are subject to the same penalties and the same procedures and sale in case of delinquency as provided for such taxes.

SECTION 7: Direct Billing. If for any reason the full amount of any sewer service charges are not collected in accordance with the provisions of Section 6 of this Ordinance, the sewer service charges, or the portion thereof not appearing on the tax roll, will be collected by direct billing of the property owner, as provided in this Section. The provisions of this Section will also apply to sewer service charges accruing after a new connection to the County's wastewater facilities, in which case the annual charge will be prorated over the period of time from the date of the new connection to the end of the fiscal year.

A. Billing. The County will ascertain the amount of each sewer service charge applicable to such property and will mail to the owner after the date any sewer service charges become due and payable, a bill for the sewer service charges that are then due and payable. The bill will be mailed to the person or persons listed as the owner on the last equalized assessment roll of the County of San Luis Obispo at the address shown on the assessment roll, or to the successor in interest and/or the lessee of such owner; if the name and address of any successor in interest or lessee is known to the County. Each bill will contain a statement that a delinquency in payment for sixty (60) days constitutes a lien on the parcel against which the charge is imposed and that when recorded the lien will have the force, effect and priority of a judgment lien for three (3) years unless sooner released or otherwise discharged. * Failure of the County to mail any bill or failure of owner to receive such a bill does not excuse the owner from the obligation of paying sewer service charges for premises owned by him or her.

B. How Payable. Each sewer service charge to be collected by direct billing is due and payable in full at the time of billing or at the time specified in the bill.

C. Delinquency Date of Sewer Service Charges. Each sewer service charge is delinquent if not paid on or before the thirtieth (30th) day of the month following the date upon which the sewer service charge became due and payable.

D. Penalties for Non-Payment of Sewer Service Charges – Lien. Whenever a delinquency occurs for non-payment of sewer service charges, a penalty of ten (10) percent attaches to the charges, and for each month that any portion of the charges remain delinquent, a further penalty of one and one-half (1-1/2) percent of the unpaid charge is added.

SECTION 8: This ordinance shall take effect and be in full force and effect thirty (30) days after its passage and before the expiration of fifteen (15) days after passage of this ordinance, it shall be published once with the names of the members of the Board of Supervisors voting for and against the ordinance in a newspaper of general circulation published in the County of San Luis Obispo, State of California.

Impacts on Other Funds / Other County Work LOWWP Oct. 2010 update (Staff report)

The Budget adjustment recommends a corresponding reduction in the General Fund contribution to Roads. The following is a summary of the Project's preliminary funding:

#10

	From the County General Fund	From the County General Fund via reductions in General Fund Contributions to Roads	From the General Fund via Reductions in Services to Special Districts
Prior Approvals	$6,000,000	$1,250,000	$200,000
Current Recommendation	0	$750,000	0
Total	$6,000,000	$2,000,000	$200,000

When this is reimbursed, will there be enough money to restore roads?

The increase in the Project budget and the corresponding reduction in General Fund contributions to Roads will not negatively impact the pavement management projects that are recommended for current Board approval (also on the agenda for October 5, 2010). In addition, Pavement Management funds of approximately $3.0 M will be available for the 2011 Pavement Management spring contract. A table listing Roads priorities for the Pavement Management system is included at the end of this section. Since interim funding can be anticipated in 2011, the reduction in General Fund support for Roads will be replenished in 2011.

At previous Project updates, staff had verbally indicated that the reimbursement of funds, once re-appropriated to Roads, will need to include serious consideration for allocation to Los Osos. The level of deferred maintenance for Los Osos has been significant while the LOCSD went through its project efforts, and during the past four years since the approval of AB 2701. In addition, the County's Roads fund cannot expect the wastewater Project alone will repave all the roads impacted by the collection system. The issue of proper road repair after installation of the Project's collection system is the same one encountered when utilities (such as the Gas Company) do work in public rights of way. Clearly no project should be required to do more than its share to repair roads that have deteriorated because maintenance has been deferred. Public Works staff is analyzing the nexus and proportionality issues to determine an appropriate plan for financing and executing the rehabilitation of roads in Los Osos.

In order to address the Project's impacts on County Roads, and the Project's physical and/or financial requirements to mitigate the impacts is currently being evaluated by the Transportation and Roads staff within the Department. The additional funding that should be provided by the Roads fund, to ensure that the roads are restored after the Project is complete, is also being evaluated. *

#11 OR

Recommended LOWWP Cost Containment Measures

From K. Wimer letter to Board of Supervisors, May 17, 2010, "Subject: Questions/concerns relating to escalating LOWWP project costs and the Rates and Charges Proposition 218 Assessment process approved by your Board on April 27, 2010"

Please identify which of the following cost reduction/containment measures will be put into place (and why a particular measure will not be implemented, if it will not).

1. A cap on project costs at contractor bid amounts (i.e., no change orders) (This helps assure bids are truly competitive, i.e., what you see is what you get.)
2. A performance bond for 100% of the cost of a particular project component (e.g., the collection system component) to complete construction of the component if contractors fail to perform.
3. A performance metrics that requires contractors to meet high standards of performance, which includes rigorous testing and inspection procedures for installation and materials.
4. Technical and delivery performance incentives, which reward or penalized a contractor for performing above or below established baseline performance levels. (We've attached an incentive structure used by Northrop Grumman to encourage both technical and timeline performance.)
5. A warranty for 5-10 years on all materials and workmanship (or a maintenance contract for the same period of time).
6. A cap on County administration costs upfront.
7. An independent audit/review (initially and ongoing) to assure project expenditures and timelines stay on track (and waste is kept to a minimum).
8. Contractors are allowed to submit design-build proposals that integrate more than one project component (e.g., collection, treatment, and recycled water reuse) to reduce administration/design costs and promote innovative designs and solutions.
9. Montgomery Watson Americas is excluded from the bidding process. A New Orleans Inspector General's report is reason enough to exclude the firm from the RFP process (e.g., with a condition excluding companies with certain types of complaints filed against them).
10. STEP/STEG is allowed to compete in the design-build bidding process.

LCP Coastal Watershed Policy #1: ñPreservation of Groundwater Basinsò
"The long-term integrity of groundwater basins within the coastal zone shall be protected. The safe yield of the groundwater basin, including return and retained water, shall not be exceeded except as part of a conjunctive use or resource management program which assures that the biological productivity of aquatic habitats are not significantly adversely impacted.ò

LCP Environmentally Sensitive Habitat Policy #2 ñAs a condition of permit approval, the applicant is required to demonstrate that there will be no significant impact on sensitive habitats and that proposed development or activities will be consistent with the biological continuance of the habitat.

LCP Coastal Watershed Policy #3: ñMonitoring of Resourcesò
In basins where extractions are approaching groundwater limitations, the county shall require applicants to install monitoring devices and participate in water monitoring management programs.

LCP Coastal Watershed Policy #5: ñLos Osos Groundwater Managementò
The county Planning and Engineering Departments should work with communities, property owners and the Regional Water Quality Control Board to develop and implement a basin-wide water management program for the Los Osos groundwater basin which addresses:

-existing and potential agricultural demand
-urban expansion in relation to water availability
- groundwater quality
-possible need for alternative liquid waste disposal
-protection of aquatic habitats including coastal waters, streams and wetlands.

The Resource Management System of the Land Use Element provides a framework for implementing this policy and an interim alert process for timely identification of potential resource deficiencies, so that sufficient lead time is allowed for correcting or avoiding a problem.ò

LCP Environmentally Sensitive Habitat Policy #7: ñCoastal wetlands are recognized as environmentally sensitive habitat areas. The natural ecological functioning and productivity of wetlands and estuaries shall be protected, preserved and where feasible, restored.ò

San Luis Obispo County
Los Osos Wastewater Project Development

VIABLE PROJECT ALTERNATIVES

FINE SCREENING ANALYSIS

FINAL
August 2007

carollo
Engineers...Working Wonders With Water™

In association with Crawford Multari & Clark ASSOCIATES Cleath & Associates Engineering Geology/Hydrogeology

Reductions in lower aquifer production have a greater mitigation value for seawater intrusion the closer they are to the coast. These mitigation values range from 0.55 on the west side of the basin to 0.10 in the Los Osos Creek valley, based on the results of ground water modeling. This means that for every acre-foot of water not removed from the ground, there is a seawater intrusion mitigation benefit of 0.55 AF to 0.10 AF (depending on the location). For example, a value of 0.1 mitigation applies to agricultural reuse where pumping from the lower aquifer beneath the creek valley is reduced by using reclaimed water "in lieu" of wells. In an "exchange" mode, these agricultural wells would continue to pump, and the water would be used in the community supply while the crops would be irrigated with reclaimed water. This "agricultural exchange" water could offset lower aquifer production on the west side of the basin, which would provide the full 0.55 mitigation value.

Current purveyor production from the lower aquifer is estimated to be 1,790 AFY, of which approximately 1,000 AFY is from wells on the west side of the basin where maximum mitigation potential exists. Therefore, the maximum practical seawater intrusion mitigation available from disposal methods that offset lower aquifer purveyor production is estimated to be 550 AFY (i.e. the 0.55 mitigation factor times the 1000 AFY production from the west-side wells). This level of lower aquifer production offset, however, would require significant changes to the water distribution systems that may take years to properly assess, fund, and implement.

Currently, lower aquifer recharge west of the Los Osos Creek Valley comes primarily from upper aquifer leakage. The amount of leakage is controlled by the difference in pressure above and below the regional aquitard. The disposal method that most significantly increases upper aquifer pressure and therefore the lower aquifer recharge on the west side of the basin is the Broderson site. If the Broderson site is utilized for 448 AFY disposal, the resulting seawater intrusion mitigation benefit would be approximately 100 AFY. If the Broderson site is used for 896 AFY disposal, the resulting seawater intrusion mitigation benefit would be approximately 200 AFY.

Reaching Level 3 and Level 4 seawater intrusion mitigation involves the participation of the water purveyors. Level 3 projects are developed in this report. The difference between Level 3 project and Level 4 projects is entirely composed of actions by the water purveyors and are not related to the wastewater project. Therefore, Level 4 projects are not developed in this report.

2.2 REUSE/DISPOSAL ALTERNATIVE CONSIDERATIONS

The ability to provide a viable reuse/disposal component for the wastewater project depends on several factors such as seawater intrusion mitigation, capacity, required treatment level, and the participation from the water purveyors, as discussed below. These factors are summarized in Table 2.3, and discussed in the following sections.

Table 2.3 Reuse/Disposal Considerations
Los Osos Wastewater Development Project
San Luis Obispo County

Disposal/Reuse Alternatives	Disposal Capacity (AFY) For Fully Developed Alternative[1]	Seawater Intrusion Mitigation Factor	Total Seawater Intrusion Mitigation (AFY)	Denitrification Likely Required (AFY)	Tertiary Treatment Likely Required (AFY)	Requires Purveyors' Participation
Spray Fields	1,190	0	0	No	No	No
Cemetery Reuse (in lieu)	50	0.1	5	Partial[2]	Yes	No
Urban Reuse (in lieu, large sites)	63	0.55	35	Partial[2]	Yes	Yes
Agricultural Reuse (in lieu)	460	0.1	46	Partial[2]	Yes	No
Agricultural Exchange	460	0.55	250	Partial[2]	Yes	Yes
Leachfields/Percolation Ponds without Harvest Wells (Broderson site)	448	0.22	100	Yes	No	No
Leachfields/Percolation Ponds with Harvest Wells (Broderson site)	896	<0.22[3]	<200[3]	Yes	No	Yes
Other Actions Influencing Seawater Intrusion Mitigation[4]						
Conservation[5]	160 (at buildout)	0.55	90			No
Harvest Water Exchange[6]	none	0.55	Up to 550[7]			Yes

Notes:
(1) The project is estimated to require a total disposal capacity of 960 AFY at current conditions and 1350 AFY at buildout, which can be reduced to 1,190 AFY with conservation.
(2) The NWRI report (2006) stated that effluent disposed by land application (i.e., spray irrigation) will not need to undergo nitrogen removal when applied at agronomic rates. However, application of high concentrations of nitrogen would exceed agronomic rates, so partial denitrification to between 10 and 20 mg/L N may be necessary.
(3) Harvesting water to prevent mounding when Broderson is used in excess of 448 AFY reduces the volume of water that percolates to the lower aquifer.
(4) These Other Actions are not reuse/disposal alternatives and therefore do not have an associated capacity.
(5) Conservation is assumed to be achieved through a toilet retrofit program financed by the wastewater project. Although it is not a disposal alternative, it provides an equivalent benefit to 160 AFY disposal capacity.
(6) Does not address wastewater disposal (capacity) and is therefore considered beyond the scope of the wastewater project.
(7) The total mitigation value of harvest water, urban reuse, agricultural exchange, conservation and any other activity that reduced production from the lower aquifer cannot exceed 550 AFY, which is the expected rate of seawater intrusion once septic flows are moved out of town.

2.2.1 Capacity of Alternatives

Spray field disposal is the only alternative that has sufficient capacity to accept the entire buildout flow of 1,350 AFY, which corresponds to 1.2 million gallons per day (mgd). However, spray fields do not mitigate seawater intrusion because all the potential sites are located outside the groundwater basin. Therefore, alternatives need to be combined to create a viable project alternative with the capacity to mitigate seawater intrusion (to various levels) and dispose of all the treated effluent. The reuse/disposal viable project alternatives that were carried forward are discussed in Section 2.5.

2.2.2 Treatment Requirements

As addressed in the Rough Screening Report, different reuse/disposal options have different treatment requirements. Tertiary treatment and denitrification are the two treatment requirements that will likely differ between the alternatives. Tertiary treatment is required by the California Department of Health Services to protect public health for any alternative where there may be human contact with the water, such as agricultural or urban reuse. Denitrification will be required for alternatives where land application of effluent could lead to nitrate contamination of the groundwater. For example, the spray field alternative offers the opportunity to assimilate effluent nitrogen into plants that are harvested and removed, so denitrification may not be required. Public contact with the effluent can be limited, so tertiary treatment to protect public health may not be necessary for spray fields. Other alternatives will likely require tertiary treatment, denitrification, or both. Alternatives that require tertiary treatment or denitrification will increase treatment costs.

2.2.3 Alternatives Requiring Purveyors' Cooperation

Any alternative including a modification or change in operation of current water system practices or infrastructure would require the participation of the water purveyors. Because the maximum benefit for seawater intrusion involves reduced pumping from the lower aquifer, it is only possible to achieve a balanced groundwater basin with purveyor support and cooperation.

Additionally, there are several strategies that are beyond the scope of the wastewater project that the water purveyors could adopt in order to further balance the basin and reduce seawater intrusion, including:

- Pumping the upper aquifer for irrigation, or for treatment and augmentation of drinking water supplies (this includes harvest well production)
- Implementing further conservation measures
- Implementing a storm water runoff detention program for aquifer recharge
- Importing water

2.3 POTENTIALLY VIABLE REUSE/DISPOSAL PROJECTS

2.3.1 Project Benefits

Benefits for each of the potentially viable projects are based on the levels of seawater intrusion mitigation achieved. Seawater intrusion mitigation can be addressed by a combination of disposal/reuse alternatives that either include the use of the Broderson or use other mitigation and disposal options. As shown in Table 2.4, a Level 1 seawater intrusion mitigation project can be achieved without use of the Broderson site and without purveyor participation. However, beyond Level 1 mitigation, any combination of disposal/reuse options without purveyor participation will require the Broderson site to achieve these levels of project benefit. With purveyor participation, use of Broderson is not necessary to achieve any desired level of seawater intrusion mitigation.

Table 2.4 Types of Projects
Los Osos Wastewater Development Project
San Luis Obispo County

Project Mitigation Level	Level 1	Level 2	Level 3
With Broderson	✖	✔	✔
Without Broderson	✔	✖	✔

Note: ✔ indicates types of projects that are discussed in this section. ✖ indicates types of projects that were not developed in this report because they were screened out by the criteria listed in section 1.1.2. Alternatives with a hatched background require purveyor participation.

2.3.2 Viable Project Alternatives

Based on the goals of the project to mitigate seawater intrusion, provide adequate capacity for wastewater disposal, and to contain project cost, the following considerations were included in developing the short list of viable project alternatives:

- Conservation should be a part of all alternative projects. Conservation works to reduce both wastewater flows and seawater intrusion. A toilet retrofit program has already been approved for the community and the community has consistently supported water conservation.
- Reuse at the cemetery should be part of all alternative projects that already require tertiary treatment. All first-tier alternative plant sites are in close proximity to the cemetery, which

Level 2 is defined as the project with the maximum seawater intrusion mitigation possible without purveyor participation. Therefore, no Level 2 project that requires purveyor participation was developed.

With purveyor participation, it is possible to reach higher level of seawater intrusion mitigation. Full mitigation (i.e. balancing the basin) requires the reduction of pumping from the lower aquifer and therefore purveyor participation. Level 3 projects with and without the use of the Broderson site were developed as part of this fine screening report.

will minimize the cost of implementing this disposal/reuse option. The cemetery irrigation well is on the west side of the creek valley, and therefore eliminating this pumping results in beneficial seawater intrusion mitigation.

- If Tonini Ranch is selected as a spray field disposal site, the water that is currently being pumped for irrigation at the site could be returned to the water distribution system. This potential alternative has not been investigated yet, nor have costs to implement it been estimated at this time.
- Based on the amount of land used for agriculture, the capacity for agricultural reuse of the wastewater effluent is estimated to be approximately 800 AFY in the Los Osos Creek Valley. Implementation of an agricultural reuse program would likely require a smaller “demonstration” project involving contracts with a few growers. Over time, demonstration of successful reuse at these sites could lead to increased participation in the program by other growers. Alternatively, land could be purchased and leased to growers under the condition that they use recycled water. However, purchase of the land would increase the cost of the project considerably (i.e. by approximately $40,000/acre). Projects with a range of agricultural reuse components will be considered.
- Projects that do not require purveyor participation and, therefore, that are achievable as part of a wastewater project, were given priority in the fine screening process. Projects that required purveyor participation such as upper aquifer harvesting and agricultural exchange were considered to be beyond the scope of the project, although they are still explored in this report. There are several reasons for this exclusion of projects requiring purveyor participation:
  - For the Tri-W project, water purveyor acceptance of upper aquifer harvest water upon initial project start-up was uncertain. The phasing of harvest water into the community supply was to take place after a few years of plant operation, if at all.
  - The feasibility of obtaining contracts for agricultural exchange water is unknown. Agricultural reuse, which is the first step toward agricultural exchange, is likely to begin at a relatively low level and expand over time as growers become accustomed to the practice. Agricultural exchange would evolve in similar fashion, but only after the growers are confident that reuse is a practice that is beneficial to their business.
  - Any new sources of water supply will require purveyors to address both regulatory and infrastructure issues that are outside of the scope of the fine screening process. For example, purveyor pipe diameters may be undersized for accepting a new source at the closest points of delivery. Pressure zone management will almost certainly preclude purveyors from shutting down lower aquifer production wells (as the new sources come on-line) without significant planning, hydraulic modeling, and redesign of the existing water storage and distribution systems.

- Urban in lieu reuse (from upper aquifer or wastewater sources) is not incorporated into the fine screening of the viable project alternatives. The reasons for this were:
  - Any form of urban wastewater/upper aquifer water reuse requires direct purveyor intervention and should be considered primarily a purveyor project. Customer service, meeting on-site regulatory requirements, flow metering, and billing would all be handled by the purveyor.
  - Costs for locally constructed or existing upper aquifer irrigation wells will be much less than using treated effluent to irrigate large parcels due to the pipeline construction costs to convey the effluent several miles from the wastewater treatment facility. For example, costs to run pipelines to large sites in Los Osos are estimated to be approximately $2.5 million, while these sites can only dispose of a small fraction of the effluent (i.e. approximately 68 AFY compared to 1190 AFY total at buildout). The exceptions would be recycled water distribution to Sunnyside School and the Community Park if Broderson is developed, which can potentially accept 10 AFY.
  - Three of the four major urban reuse sites do not significantly mitigate seawater intrusion. The cemetery site (46.9 AFY demand) is already included in the alternative projects. The Tri-W site (21.6 AFY demand) demand will move to wherever the plant is situated. No seawater intrusion mitigation can be credited for irrigating the wastewater treatment plant (WWTP) site, since that demand does not exist in the current condition. Seawater intrusion has already reached the third potential reuse site, Sea Pines Golf course (16.5 AFY demand). Lower aquifer production for golf course irrigation has been minimized due to increasing salt concentrations, and has already been replaced by upper aquifer water and treated wastewater from the Monarch Grove subdivision. The last major reuse site is Los Osos Middle School (24.7 AFY demand), where there is a suitable nearby upper aquifer well (former Walker parcel) that could serve the school at a lower cost than bringing in wastewater, or a new well could be drilled at the Paso Robles harvest well site at a lower cost than bringing in wastewater.
  - Urban reuse of small homeowner parcels is the most expensive disposal method. Cost estimates for delivering reclaimed water to each residence indicate that this option would be comparable to the installation of the collection system (i.e. tens of millions of dollars). Since this is much more expensive than any other viable reuse/disposal alternative, it did not pass fine screening.
- Percolation ponds (as rapid infiltration basins) are only feasible in permeable soils. Prior surveys of the percolation capacity of local soils have effectively ruled out rapid infiltration basins for areas not underlain by dune sands. Within the dune sands, the Broderson site is the preferred location for percolation of treated wastewater, based on a greater disposal capacity and mitigation potential for seawater intrusion.

Therefore, the only location at which percolation ponds were considered is the Broderson site.

In 1987, the County Board of Supervisors approved effluent disposal using percolation ponds at the Broderson site. However, at that time the community had concerns regarding potential flow releases of effluent, odor issues, vector propagation, and habitat loss. Percolation ponds at Broderson would result in permanently lost habitat to sensitive species.

For the purposes of this report, percolation ponds will be considered equivalent to leachfields since they both are located at the same site, **and they have the same capacity and seawater intrusion mitigation potential. Both of these alternatives will be referred to as "Broderson."** Leachfields have many advantages over percolation ponds, but if the community decides in the future that percolation ponds are acceptable, this will likely result in a lower capital cost of more than $2.5 million compared to an analogous project with leachfields.

2.4 REUSE/DISPOSAL VIABLE PROJECT CONFIGURATIONS

For seawater intrusion mitigation Levels 1 and 2, reuse/disposal alternatives can be developed that do not require the water purveyors' participation. Each of the projects dispose of 1,190 AFY of effluent, which is the anticipated flow at buildout with conservation. For all Level 3 projects, purveyor participation is required.

Two Level 1 alternative projects are described in Table 2.5. One of these projects includes 460 AFY of agricultural reuse (pending the actual volume of effluent that growers will agree to accept); the other does not include agricultural reuse.

Table 2.5 Level 1 Projects
Los Osos Wastewater Development Project
San Luis Obispo County

Project 1a - Full Agricultural Reuse		
Alternative Component	**Capacity**	
Spray Fields (170 acres)	680	**Total Seawater Intrusion Mitigation = 140 AFY** **Total Capital Cost = $12.7M-14.3M** **Total O&M = $100-190K/year(1)**
Agricultural Reuse	460	
Conservation	160	
Other Reuse (cemetery)	50	
Storage (290 ac-ft)		
Project 1b - No Agricultural Reuse		
Alternative Component	**Capacity**	
Spray Fields (280 acres)	1190	**Total Seawater Intrusion Mitigation = 90 AFY** **Total Capital Cost = $12.8M-15.6M** **Total O&M = $125-275K /year(2)**
Conservation	160	
Storage (210 ac-ft)		

Notes:
(1) Energy comprises $100-140K of O&M (electricity at 12 cents/kWh).
(2) Energy comprises $125-185K of O&M (electricity at 12 cents/kWh)

Both projects rely heavily on spray field disposal.

Two Level 2 alternative projects are described in Table 2.6, both of which include leachfields at the Broderson site. Similar to the Level 1 alternatives, one of these projects does not include agricultural reuse, the other assumes 460 AFY of agricultural reuse. Both projects include spray field disposal because the other alternatives that are within the scope of the wastewater project (i.e., that do not require purveyor cooperation) do not have sufficient capacity to accept the full effluent flow.

Table 2.6 Level 2 Projects
Los Osos Wastewater Development Project
San Luis Obispo County

Project 2a - Full Agricultural Reuse		
Alternative Component	**Capacity**	
Spray Fields (70 acres)	232	**Total Seawater Intrusion Mitigation = 240 AFY** **Total Capital Cost = $13.2-13.9 M** **Total O&M = $370-410K/year(2)**
Broderson (half)(1)	448	
Agricultural Reuse	460	
Conservation	160	
Other Reuse (cemetery)	50	
Storage (140 ac-ft)		
Project 2b - No Agricultural Reuse		
Alternative Component	**Capacity**	
Spray Fields (180 acres)	742	**Total Seawater Intrusion Mitigation = 190 AFY** **Total Capital Cost = $14.9-16.7 M** **Total O&M = $340-430K/year(3)**
Broderson (half)	448	
Conservation	160	
Storage (30 ac-ft)		

Note:
(1) Using Broderson at half of its full capacity of 896AFY is the maximum flow that does not require harvest wells.
(2) Energy comprises $280-300K of O&M (electricity at 12 cents/kWh).
(3) Energy comprises $250-290K of O&M (electricity at 12 cents/kWh).

Table 2.7 describes two Level 3 projects. Project 3a includes Broderson leachfields operating at 3/4 capacity (with 1/3 of this flow harvested to control rising groundwater near the bay) and project 3b does not include the Broderson site. These projects both contain agricultural exchange, where water that is currently used for irrigation will be diverted into the drinking water distribution system. To balance the basin at current conditions, the 3b project will require either a shift in water production to the upper aquifer, importation of water, or another change in water supply strategies. Project 3b is essentially the same as 1a, except that it includes agricultural exchange rather than in lieu of reuse, and it includes a shift in water production that is unrelated to effluent reuse/disposal.

Table 2.7 Level 3 Projects
Los Osos Wastewater Development Project
San Luis Obispo County

Project 3a - With Broderson

Alternative Component	Capacity (AFY)	
Spray Fields (10 acres)	none during normal precipitation years	**Total Seawater Intrusion Mitigation = 600 AFY** **Total Capital Cost = $25.6-27.3M** **Total O&M = $320K/year[3]**
Broderson (3/4)	680	
Harvest as Offset (232 AFY)		
Agricultural Exchange	460	
Conservation	160	
Cemetery	50	
Storage (115 ac-ft)		

Project 3b - Without Broderson

Alternative Component	Capacity (AFY)	
Spray Fields	680	**Total Seawater Intrusion Mitigation = 550 AFY** **Total Capital Cost = $26.0-29.8 M[2]** **Total O&M = $130-1100K/year[2,4]**
Agricultural Exchange	460	
Other Reuse (Cemetery)	50	
Conservation	160	
Shift in Water Production (400 ac-ft)[1]		
Storage (290 ac-ft)		

Notes:
(1) Shift in water production could involve water importation, upper aquifer pumping or other strategies.
(2) Lower range of costs are for upper aquifer treatment; upper range of costs are for water importation.
(3) Energy comprises $210K of O&M (electricity at 12 cents/kWh).
(4) Energy comprises $120-490K of O&M (electricity at 12 cents/kWh).

Because both Level 3 projects will involve substantial participation by the purveyors beyond the control of the wastewater project, and expenditures on their part, there is greater uncertainty in these cost estimates than for Level 1 and 2 projects.

2.4.1 Tri-W Project Effluent Disposal

As shown in Table 2.8, the Tri-W project effluent disposal included leachfields at the Broderson site, the Pismo site and the Santa Maria site. Because the Pismo Site and Santa Maria site are both on the east side of town, their use as leachfields does not provide any benefit for seawater intrusion mitigation. These three sites combined have a total capacity of 1255 AFY. However, in order to prevent groundwater mounding beneath Broderson, approximately 448 AFY needs to be harvested and disposed/reused. The Tri-W project did not set forth a solution for dealing with the harvest water.

Table 2.8	**Tri-W Project Effluent Disposal Los Osos Wastewater Development Project San Luis Obispo County**	
Alternative Component	**Capacity (AFY)**	
Broderson (full)	896	**Total Seawater Intrusion Mitigation = 285 AFY Total Capital Cost = $19.7-22.8M(1) Total O&M = $320-370K/year(2**
Harvest as Offset (448 AFY)		
Spray Fields for harvest water (100 acres)	448	
Santa Maria	147	
Pismo	147	
Conservation	160	

Notes:

(1) Capital Costs presented are based on bid tabs, escalated to 2007 dollars and added to additional cost of spray field harvest water disposal and the conservation program.

(2) Energy comprises $240-250K of O&M (electricity at 12 cents/kWh).

In order to provide a fair comparison to the other reuse/disposal projects presented in this section, spray fields have been added to the Tri-W project as a means of disposing of the harvest water. Additionally, for the purposes of comparison, conservation was added to the Tri-W project, as it was a baseline assumption for all other projects described in the previous section.

2.4.2 Seasonal Flows

The effluent flows to each of the reuse/disposal components in a project will not be constant throughout the year. The seasonality of these flows for the Level 1 and 2 projects is illustrated in Figure 2.2, and the quantitative monthly flows to each reuse/disposal component is graphed in Figure 2.3.

Agricultural reuse will only occur during the growing season, with peak reuse flows in July. There will be no agricultural reuse between December and February. For the project alternatives that include leachfields at the Broderson site, most of the winter flows can be accommodated there. However, the maximum daily capacity of the Broderson site is less than the total effluent flow. Spray fields, while operable to some extent in the winter months, have less capacity during the rainy season than the dry season, and likely cannot be operated during rainstorms. These factors necessitate the availability of winter storage. Projects that include leachfields and Broderson will need less storage, as will projects that do not include agricultural reuse, since that is the most strongly seasonally dependent reuse/disposal alternative. Water that is stored during the winter will be sent to spray fields during the spring months (except for project 3a, where most of the stored water will be sent to Broderson, since the spray fields are only for wet-year disposal).

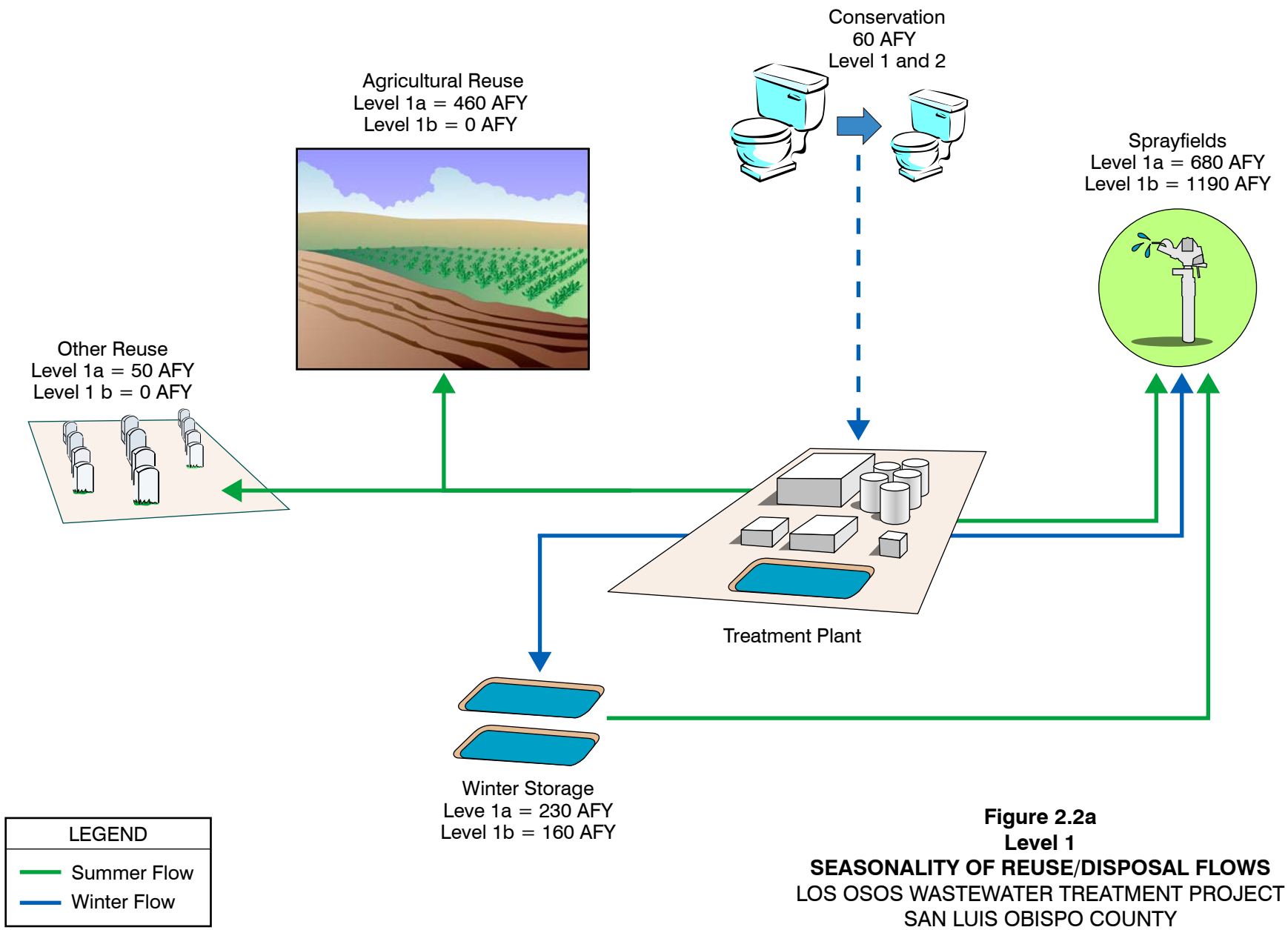

Figure 2.2a
Level 1
SEASONALITY OF REUSE/DISPOSAL FLOWS
LOS OSOS WASTEWATER TREATMENT PROJECT
SAN LUIS OBISPO COUNTY

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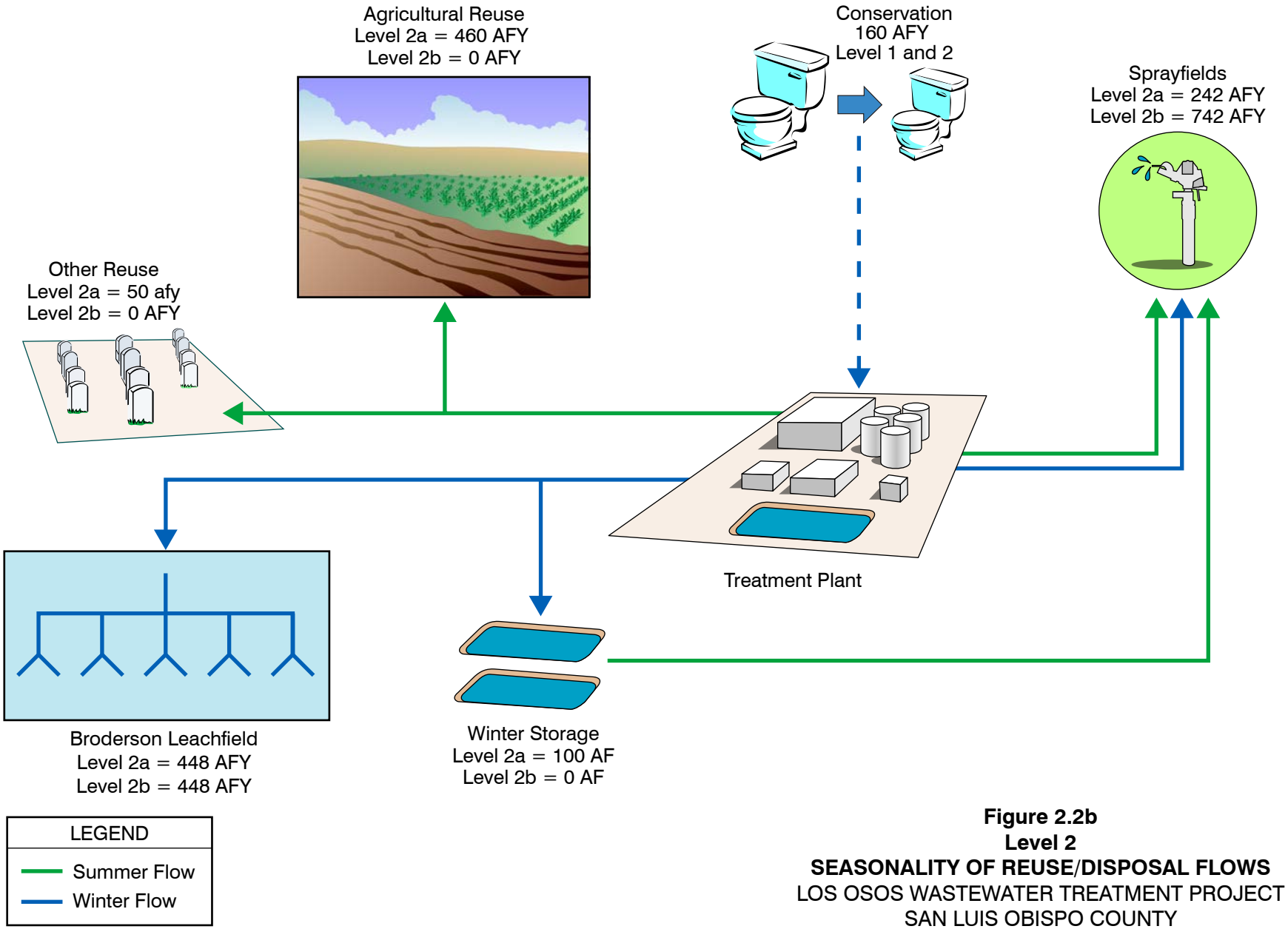

Figure 2.2b
Level 2
SEASONALITY OF REUSE/DISPOSAL FLOWS
LOS OSOS WASTEWATER TREATMENT PROJECT
SAN LUIS OBISPO COUNTY

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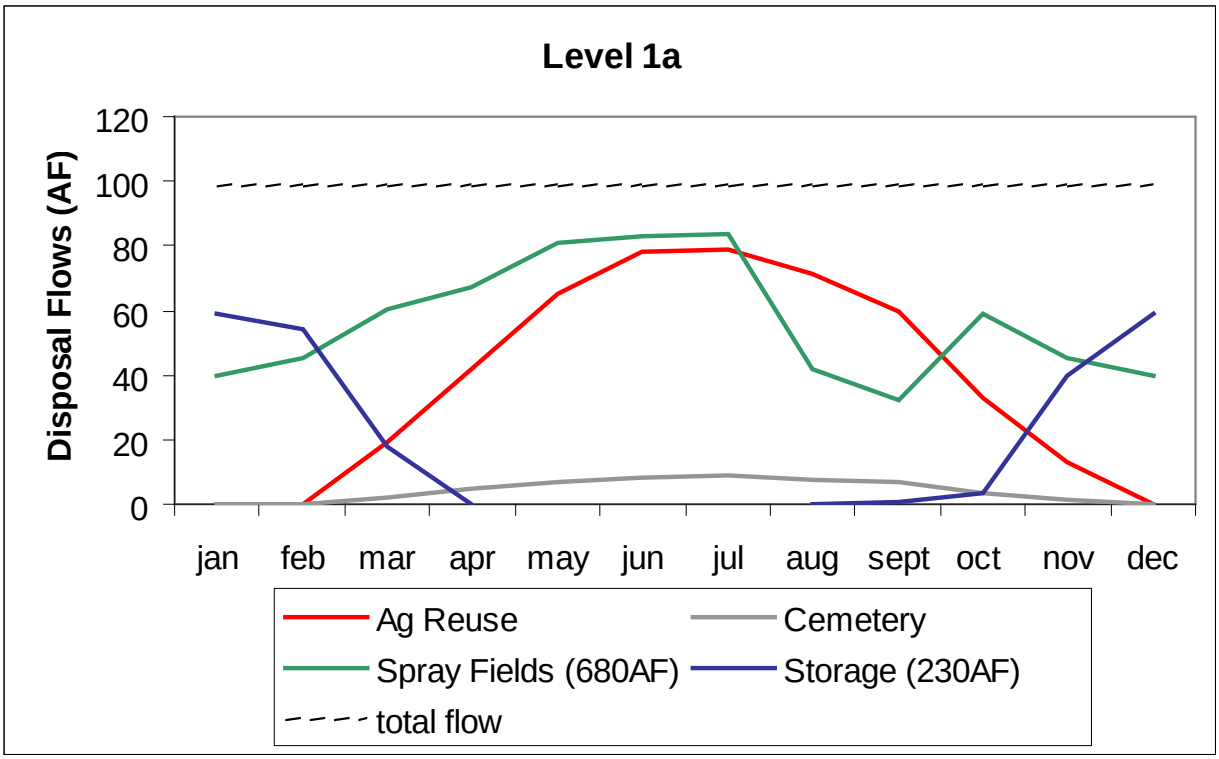

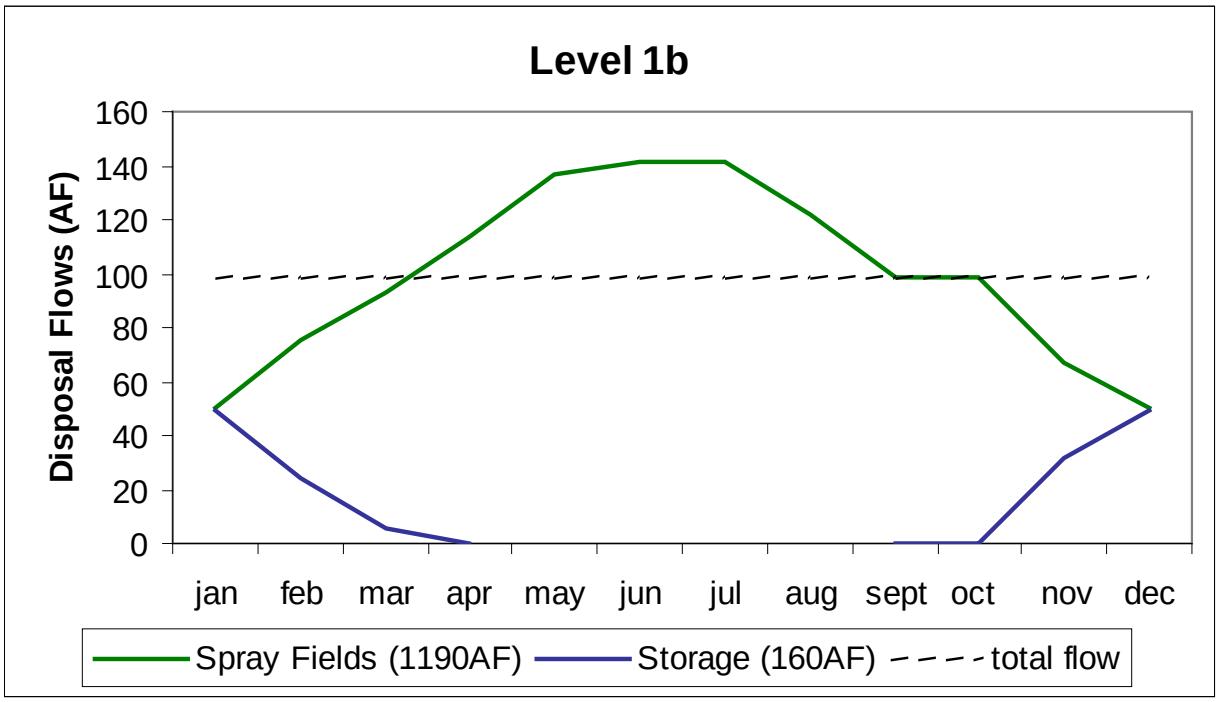

Figure 2.3a
Level 1
MONTHLY FLOWS FOR REUSE/DISPOSAL PROJECTS
LOS OSOS WASTEWATER TREATMENT PROJECT
SAN LUIS OBISPO COUNTY

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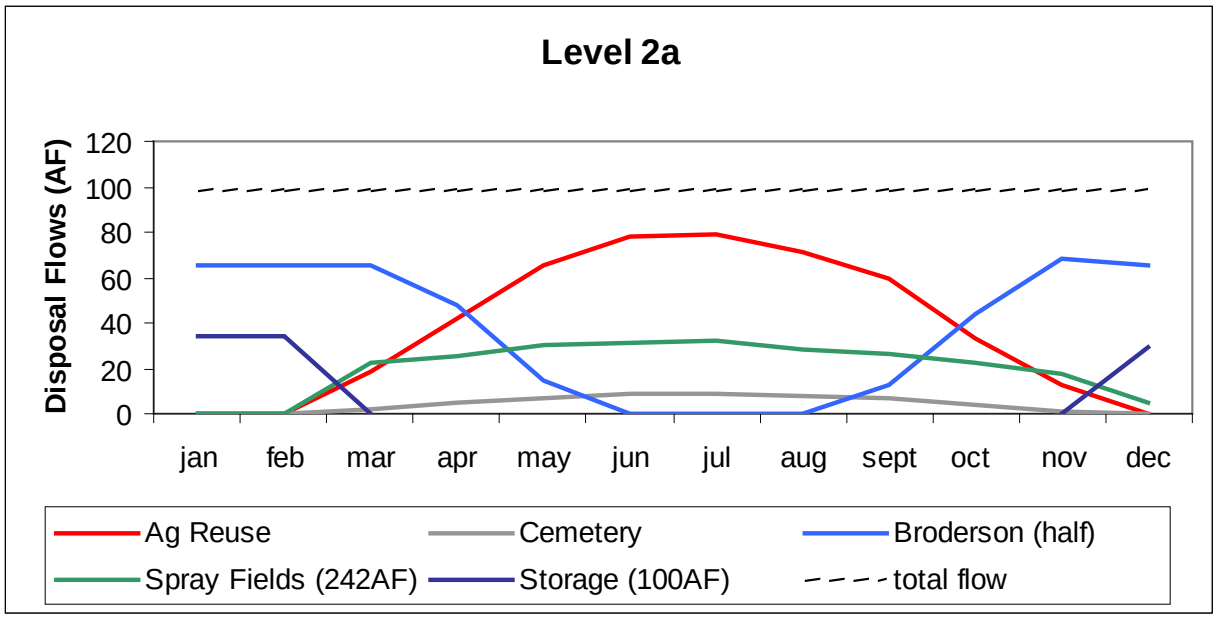

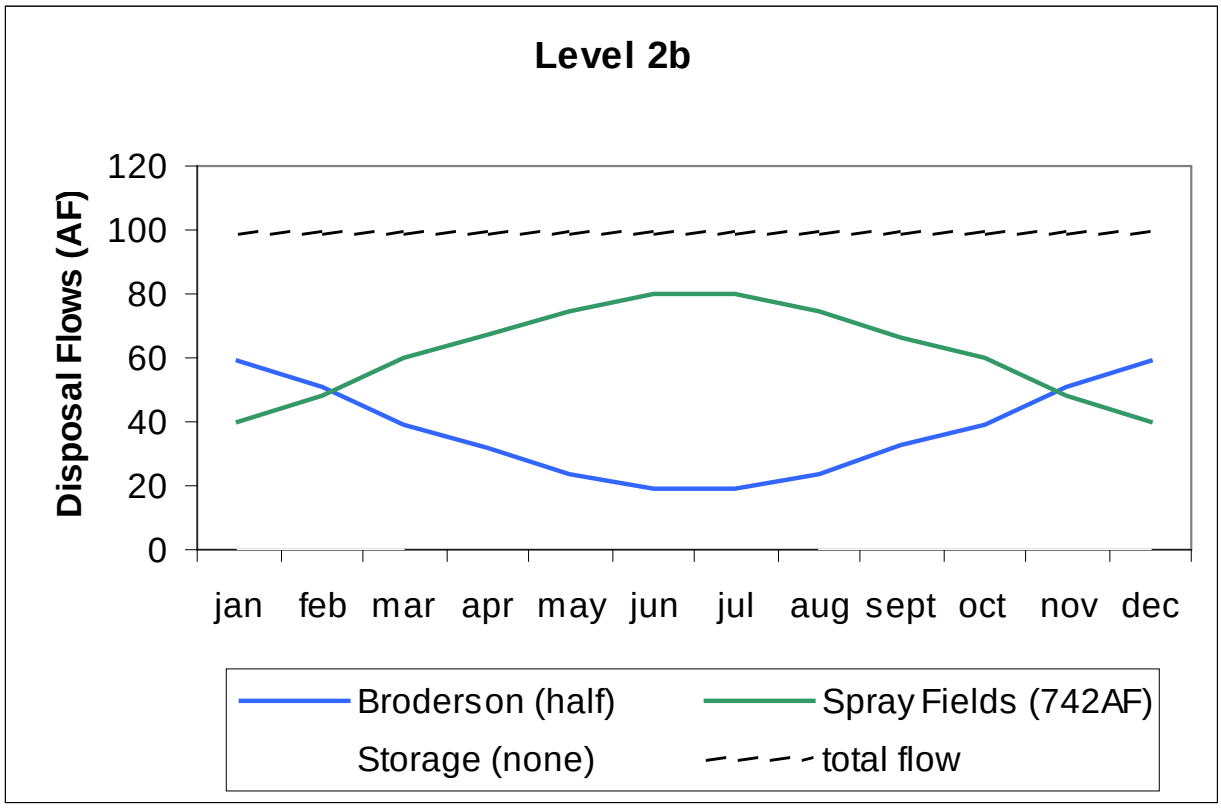

Figure 2.3b
Level 2
MONTHLY FLOWS FOR REUSE/DISPOSAL PROJECTS
LOS OSOS WASTEWATER TREATMENT PROJECT
SAN LUIS OBISPO COUNTY

During extremely wet years, the ability to dispose of water in spray fields as well as the demand for water from agricultural users will be diminished. This necessitates building extra storage capacity, as well as developing extra spray field capacity to dispose of the stored water at the end of the wet season. It was assumed that no agricultural reuse will occur between early November and late March in a wet year, so extra storage must be provided. Additionally, it was assumed that spray field use will be diminished in wet years, so flows equivalent to half of the month of March's spray field use will need to be withheld (because March is the month of the wet season where reliance on spray fields is greatest in every project scenario). The additional spray field capacity needed to dispose the effluent stored during a wet year was included in the cost of land acquisition.

Storage ponds can be planted with vegetation in order to allow them to function as wetlands. This option would provide the benefits of supplying wildlife habitat and possibly removing some wastewater contaminants such as metals. However, managing the storage ponds as wetlands would likely increase the levels of BOD, TSS and pathogens in the treated effluent. The quality of water required for the end use or disposal must be considered when determining if wetlands as storage would be suitable.

2.4.3 Reuse/Disposal Costs

The costs for the reuse/disposal projects increase with increased seawater intrusion mitigation (Figure 2.4). However, the costs for a Level 2 project are not substantially greater than for a Level 1 project.

The elements that make up the capital and O&M costs and are presented in Tables 2.5-2.7 are also presented in Appendix A.

When alternatives are combined to make viable reuse/disposal projects, there is some cost savings associated with those combinations. For example, when agricultural reuse is combined with Broderson, assuming that the treatment plant is located near Los Osos Valley Road, east of the creek, a single pipe can carry flows destined for both purposes from the treatment plant to the creek crossing.

Each of the cost estimates in Tables 2.5-2.7 is a range that reflects the cost of harvesting the spray fields. As discussed ahead in section 2.5.2, if the spray fields are required to provide the bulk of the nitrogen removal in the wastewater project, then the grasses growing on the sprayfields will have to be frequently harvested to promote nitrogen uptake. This translates to increased capital costs for machinery, and O&M costs for fuel and labor. However, if the costs for denitrification are shifted to the wastewater treatment plant, then the sprayfields do not need to be harvested.

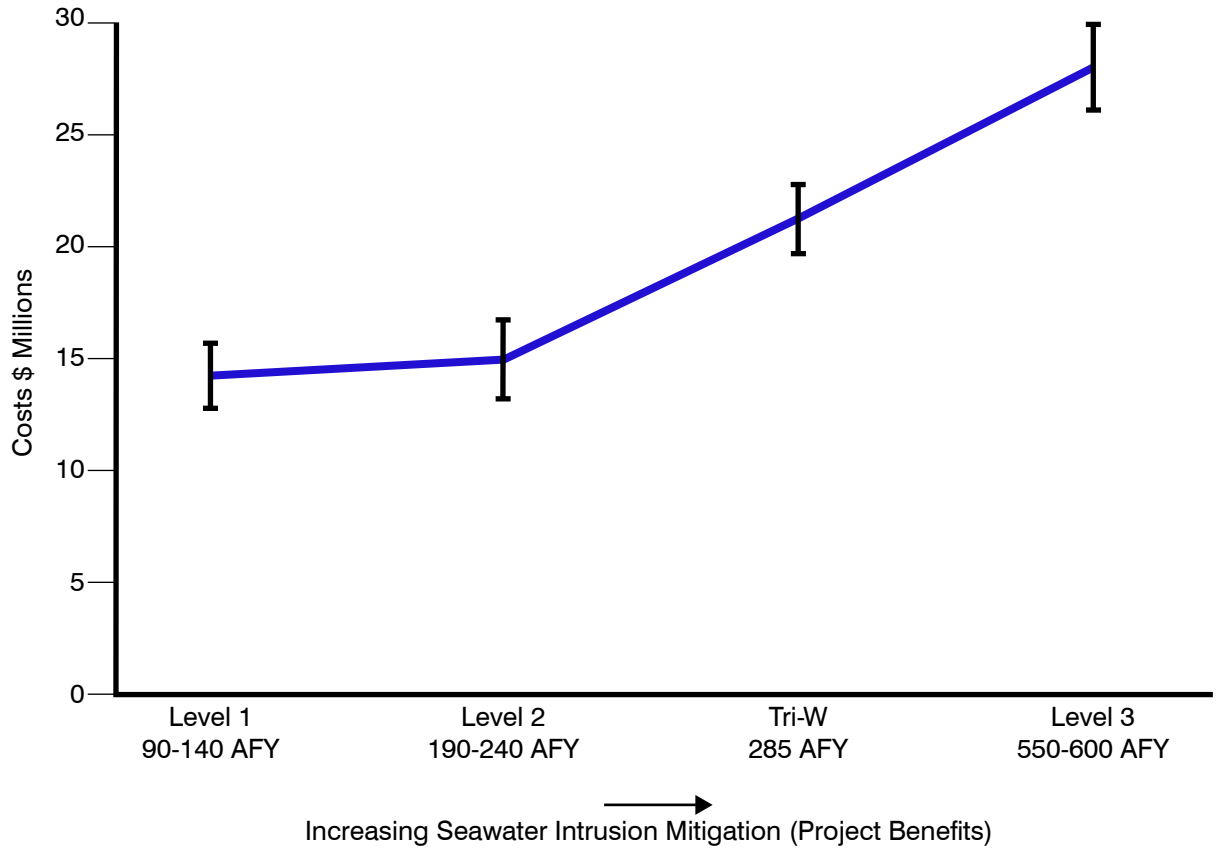

Figure 2.4
COST RANGES OF REUSE/DISPOSAL PROJECTS
ALTERNATIVE COST-BENEFIT CURVES (ILLUSTRATIVE)
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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2.4.4 Project Phasing

It is possible that if a Level 1 or Level 2 project was adopted, at some later date the water purveyors could update their infrastructure to move to a Level 3 or Level 4 project. The viable projects considered in this fine screening report are configured such that there will be no stranded assets when transitioning to a higher level of seawater intrusion mitigation.

Level 3 and Level 4 projects can only be implemented by the water purveyors, due to the changes required by the purveyors of system infrastructure and operational practices.

2.5 OTHER CONSIDERATIONS

Besides those mentioned in the previous section, other considerations impact the project selection process. Among these are the salt and nitrogen loading into the groundwater as a result of wastewater disposal/reuse, as well as other environmental, geotechnical and permitting issues. These are described in the follow sections.

2.5.1 Salt Loading

Salt loading involves the progressive mineralization of groundwater from domestic and agricultural use. The wastewater project involves a redistribution of septic flows collected in the prohibition zone, which can affect salt loading in the groundwater basin. This section compares differences in basin salt loading between the current condition and the viable project alternatives.

2.5.1.1 Current Condition

The total septic flow in the urban area is currently estimated to be 1,240 AFY. Most of these septic returns (1,120 AFY) are in the prohibition zone, and will be collected by the wastewater project. After perching layer effects, the amount of septic returns from the prohibition zone currently returning to the upper aquifer is estimated at 850 AFY.

Residential water use typically adds 200 to 300 milligrams per liter (mg/L) total dissolved solids (TDS) to the water supply, in a process called “salt pickup”. A review of monitoring data for local wastewater dischargers indicates that salt pickup in Los Osos appears closer to the low end of the range. The average TDS of the district municipal water supply in Los Osos has varied between approximately 320 and 510 mg/L in the last several years. Assuming an average water supply TDS of 420 mg/L, and a 200 mg/L salt pickup from the domestic reuse cycle, the wastewater TDS would be estimated at 620 mg/L. Recent (October 2006) sampling of septic effluent at Bayridge Estates and Vista de Oro measured 600 mg/L and 690 mg/L TDS, respectively.

Level 1

Wastewater under Level 1 projects would be distributed to spray fields outside of the basin and used for irrigation in the creek valley, at the cemetery, and at the plant site. Upper aquifer salt loading in the urban area would decrease by the total TDS content of the 850 AFY of septic return flows under current conditions, which is up to 720 tons TDS per year for Level 1 projects.

Some of the salt removed from the urban area would be applied as irrigation and percolate to aquifers underlying the Los Osos Creek valley. The average TDS in the creek valley aquifers is approximately 520 mg/L. Replacement of groundwater irrigation with wastewater irrigation is on an equal volume basis. At approximately 620 mg/L, the TDS content of Los Osos wastewater would be 100 mg/L greater than the average TDS of creek valley water. Some crops are more sensitive to salts than others, but a change in salinity from 520 mg/L to 620 mg/L TDS would not be expected to affect crop yield in the creek valley. A more detailed analysis of individual water quality constituents could be also performed, however, Los Osos wastewater quality is expected to be suitable for irrigation.

Level 2

Wastewater under Level 2 would also be distributed to spray fields outside of the basin and used for irrigation in the creek valley, at the cemetery, and at the plant site. However, in addition there would be 448 AFY disposal at the Broderson site, which would percolate to the upper aquifer. Salt loading in the urban area would decrease by an estimated 380 tons TDS per year under VPA 2, although the decrease would not be evenly distributed, and would mostly benefit the east side of the basin (Baywood Park). On the west side, with Broderson operating at 448 AFY (half of maximum capacity), the salt loading would be similar to current conditions.

2.5.2 Nitrogen Loading

Because nitrogen contamination is the primary driver of the wastewater treatment project, any disposal/reuse alternative that is selected must not exacerbate nitrate concentrations in the groundwater. With an average flow of 1.2 MGD and an effluent nitrogen concentration of between 7 mg/L and 54 mg/L (see Chapter 4), the nitrogen loading for disposal/reuse will be between 290 lbs/day and 2,200 lbs per day. Under current conditions, all nitrogen is discharged to the soils overlying the upper aquifer.

Sprayfields

If the effluent is disposed via sprayfields, then further nitrogen removal can be achieved at the sprayfield site. Residual ammonia will evaporate or quickly be converted to nitrate by biological processes. Approximately 15-25 percent of the nitrate will likely be removed though denitrification in the soil, which converts it to nitrogen gas. If perennial forage crops are planted and frequently harvested, some species can remove up to 2100 lbs/acre/year of

nitrogen under ideal conditions. With the highest loading rate of nitrogen, corresponding to a concentration of 54 mg/L, at least 300 acres of spray fields are needed to reduce the concentration of nitrogen to below the drinking water limit of 10mg/L in the groundwater beneath the fields. Under real conditions, more acreage would probably be required. However, it is unlikely that a project will be carried forward that includes effluent nitrogen concentrations of 54 mg/L.

Agricultural Reuse

The considerations for nitrogen loading for agricultural reuse are similar to that of spray fields. However, annual plants have a lower capacity for nitrogen uptake than do perennials, since they are not frequently harvested and therefore spend less of the year in a rapid growth phase. This means that more land would be required to apply the nitrate at agronomic rates.

Because the potential agricultural reuse sites are within the groundwater basin, lower concentrations of nitrogen in the irrigation water may be necessary in order to protect the groundwater during periods when the crops are not uptaking large amounts of nitrogen. Concentrations of 10 to 20 mg/L nitrogen could probably be used for crop irrigation without leading to nitrate contamination in the groundwater.

Broderson

If the effluent is disposed at the Broderson site, then an effluent limit of 7 mg/L will be required. Over many years, the water beneath the Broderson site will achieve a steady-state nitrogen concentration that should not exceed that of the effluent.

2.5.3 Environmental/Geotechnical/Permitting Considerations

Each of the reuse/disposal alternatives under consideration has its attendant environmental and permitting considerations.

2.5.3.1 Sprayfields

Sprayfields require large tracts of land, up to 270 acres depending upon soil conditions, to accommodate the entire effluent (up to 1,190 AFY). Effects include the following:

- There is the possible loss of agricultural viability; although sprayfields can be used for grazing.
- Year-round watering would cause a change in the scenic vista. Areas that previously turned brown in all but the winter and spring months would be green all year.
- Effluent constituents would change the soil makeup over time, adding sediments and salts.
- Sprayfields can only be used in weather conditions where winter runoff can be prevented.

State Water Resources Control Board
Division of Water Quality
GAMA Program

GROUNDWATER INFORMATION SHEET

Salinity

Salinity is a measure of the amount of dissolved particles and ions in water. There are several different ways to measure salinity; the two most frequently used analyses are described below:

- Total Dissolved Solids (TDS): TDS is a measure of all dissolved substances in water, including organic and suspended particles that can pass through a very small filter. TDS is measured in a laboratory and reported as mg/L.

- Electrical Conductivity (EC): The ability of an electric current to pass through water is proportional to the amount of dissolved salts in the water – specifically, the amount of charged (ionic) particles. EC is a measure of the concentration of dissolved ions in water, and is reported in µmhos/cm (micromhos per centimeter) or µS/cm (microsiemens per centimeter). A µmho is equivalent to a µS. EC can be measured in a laboratory or with an inexpensive field meter. Also called specific conductance or specific conductivity.

"Salinity" can include hundreds of different ions; however, relatively few make up most of the dissolved material in water: chloride (Cl^-), sodium (Na^+), nitrate (NO_3^-), calcium (Ca^{+2}), magnesium (Mg^{+2}), bicarbonate (HCO_3^-), and sulfate (SO_4^{-2}). The concentrations of boron (B), bromide (Br), iron (Fe), and other trace ions can be locally important.

Approximate Total Dissolved Solids (TDS) Values in Natural Waters

Natural Water	TDS (mg/L)
Precipitation	10 mg/L
Pristine Freshwater Lakes and Rivers	10 to 200 mg/L
Amazon River	40 mg/L
State Water Project Deliveries	275 mg/L
Lakes Impacted by Road Salt Application	400 mg/L
Agricultural Impact to Sensitive Crops	500 mg/L
Colorado River Water	700 mg/L
California Drinking Water Limit*	1,000 mg/L
Average Seawater	35,000 mg/L
Brines	>50,000 mg/L
Groundwater	100 to >50,000 mg/L

*Secondary Maximum Contaminant Level. mg/L = milligrams per liter, or parts per million (ppm)

Revised March 2010

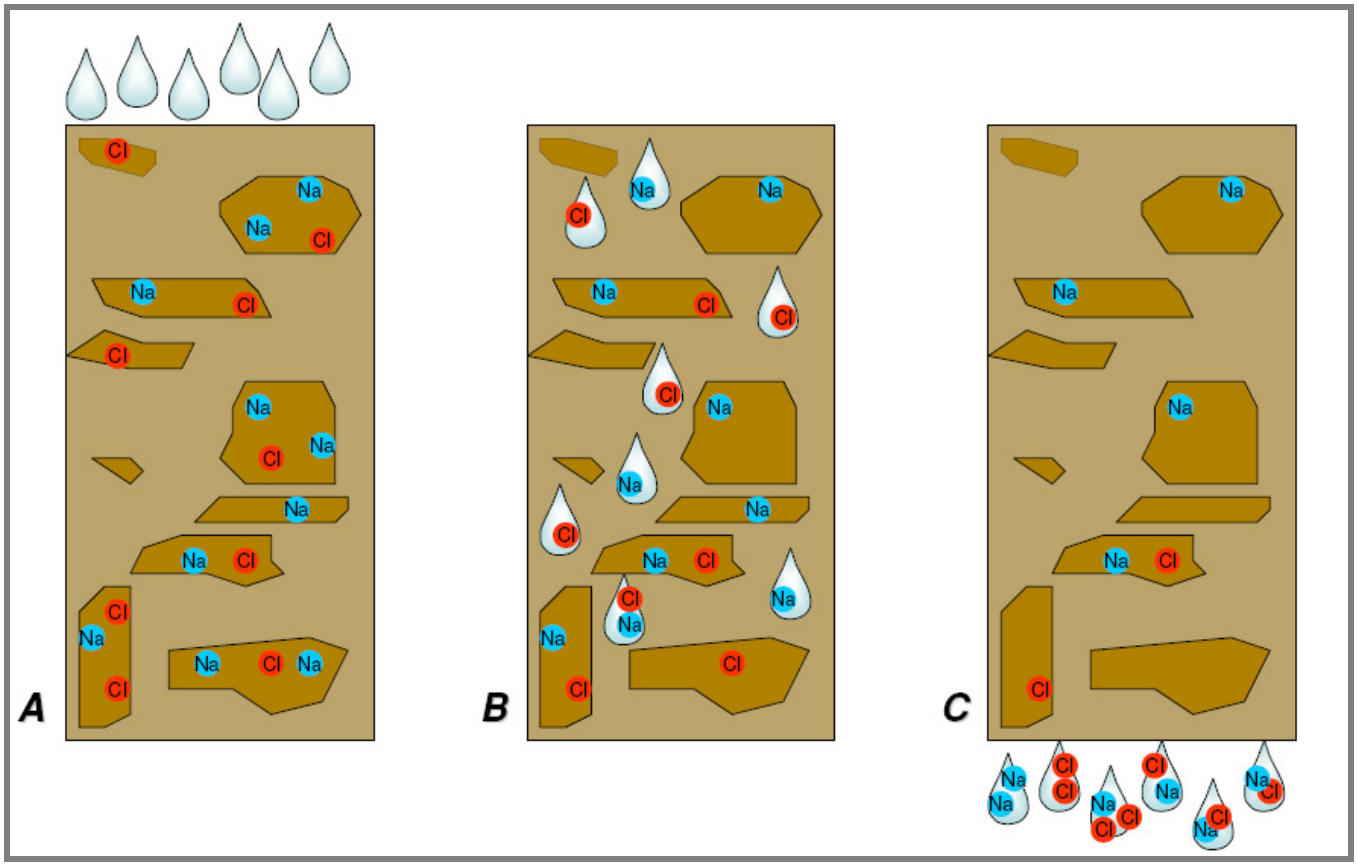
The clarity of water is unrelated to salinity (TDS). For example, visibility in the ocean can be hundreds of feet, even though ocean water has a very high salinity (TDS of 35,000 mg/L). On the other hand, water with low visibility like the Mississippi River can have low TDS (~200 mg/L) because the particles that obscure visibility are not *dissolved*, and can be easily filtered from the water. The amount of dissolved material in natural waters is a complex function of climate, land-use patterns, human activity in the watershed, and geologic make-up of the hydrologic basin.

Adverse Effects

High concentrations of salts can damage crops, affect plant growth, degrade drinking water, and damage industrial equipment. High concentrations of nitrate are a health threat. Most salts do not naturally degrade, and can remain in groundwater for decades. The economic cost of increased groundwater and surface water salinity to California – manifested in fallowed farmland, unsuitable drinking water, and environmental degradation – is estimated in the millions of dollars annually.

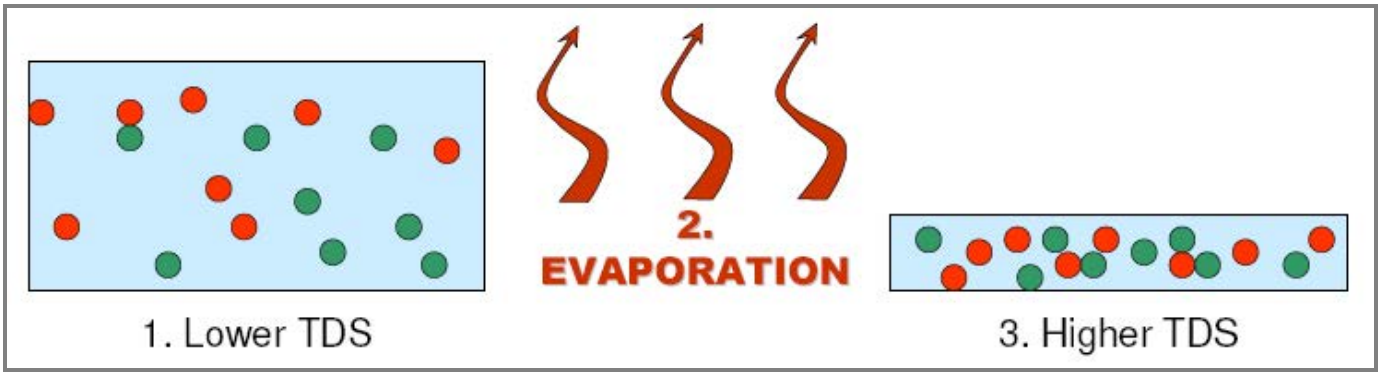
Sources of Salt

Salts enter groundwater naturally through dissolution of soil, rock, and organic material. A schematic illustrating how dissolution occurs is shown below.



Dissolution of Natural Materials*: Water is introduced to the soil from irrigation or rain (A). As the water percolates downwards it dissolves ionic and non-ionic particles from minerals in the soil column (B). The water that leaves the soil to the underlying groundwater is enriched in salts (C).*

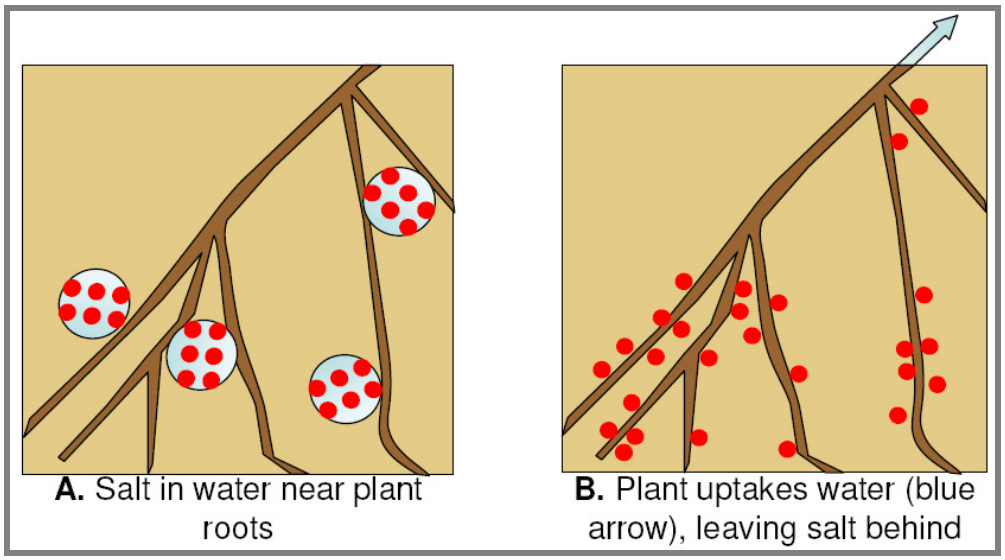
The concentration of salts in surface and groundwater can increase in several ways. *Increased dissolution* can increase salinity levels. *Evaporative enrichment* is the process of increasing salinity levels in surface or groundwater by removing water via evaporation. For example, irrigation water is often applied to crops during the summer when evaporation rates are highest. As water molecules evaporate into the atmosphere, salts remain behind in the irrigation water. This irrigation water can percolate into the underlying groundwater. If the groundwater is later pumped and used for additional irrigation, the evaporation cycle is repeated and salinity levels will continue to increase. *Dryland salinity* affects soils when groundwater is brought to the surface by capillary action; evaporation removes water and leaves salt at the soil surface.



Evaporative Enrichment*: As water evaporates, salts will remain behind. As a result, the concentration of salts in water with a relatively low starting salinity (TDS) can increase simply due to evaporation. Irrigation can result in significant increases in salinity through evaporative enrichment.*

Water uptake by plants can also increase soil salinity. Water percolating through the ground has salts dissolved in it. Plant roots work by taking in water while excluding salts and other non-nutrients. The excluded salts will gradually build up around the roots, and must be periodically "flushed" from the root zone or plant death may occur. In natural systems, the types of plants found in a specific environment are adapted for naturally-occurring soil salinities. In many agricultural areas, salts are flushed from the soil by applying irrigation water. The salts that are flushed from the soil either enter groundwater or are discharged to surficial drains.

Human activities also affect salinity levels in ground and surface water. Application of synthetic fertilizers, manures, and wastewater treatment facilities can all contribute salt to surface and groundwater. Nitrogen is a necessary nutrient for plant growth, and nitrogen fertilizers are typically in the form of the salt nitrate. If excess nitrate fertilizer is applied to a field, the nitrate not used by plants can dissolve and move to groundwater. Manure from confined animal facilities is enriched in nutrients and other salts, and can also increase salinity levels in receiving waters. Domestic wastewater is typically enriched in salts due to household activities such as washing and water softening. Most water treatment facilities cannot remove salt. As a result, discharges from these facilities can increase surface and groundwater salinity.



Plants Increase Soil Salinity*: Soil pore water used by plants contains dissolved solids and other salts (A). Water uptake by roots will exclude salts and dissolved solids. Over time, as water is moved upwards through the roots to the rest of the plant, salts will build up in the soil surrounding the roots (B). Salts must be periodically flushed from the soil; otherwise, rising soil salinities may cause the plant to die.*

Summary of Salinity Sources:

- Agriculture: Evaporation of irrigation water will remove water and leave salts behind. More salt can be dissolved from soil as irrigation water percolates downward. Plants can naturally increase soil salinity as they uptake water and exclude salts. Application of synthetic fertilizers can increase nitrate concentrations in surface and groundwater. Manure from confined animal facilities is enriched in nutrients and other salts, and can also increase salinity levels in receiving waters.

- Municipal: Detergents, water softeners, and industrial processes all use salts – wastewater discharged to POTWs and septic systems is often more salty than the original source water. Discharges from POTWs and septic systems can increase the salinity of receiving waters. Overwatering of lawns and residential use can also contribute to salinity.

- Industrial: Many industrial processes can increase salinity in process wastewater. Cooling towers, power plants, food processors, and canning facilities.

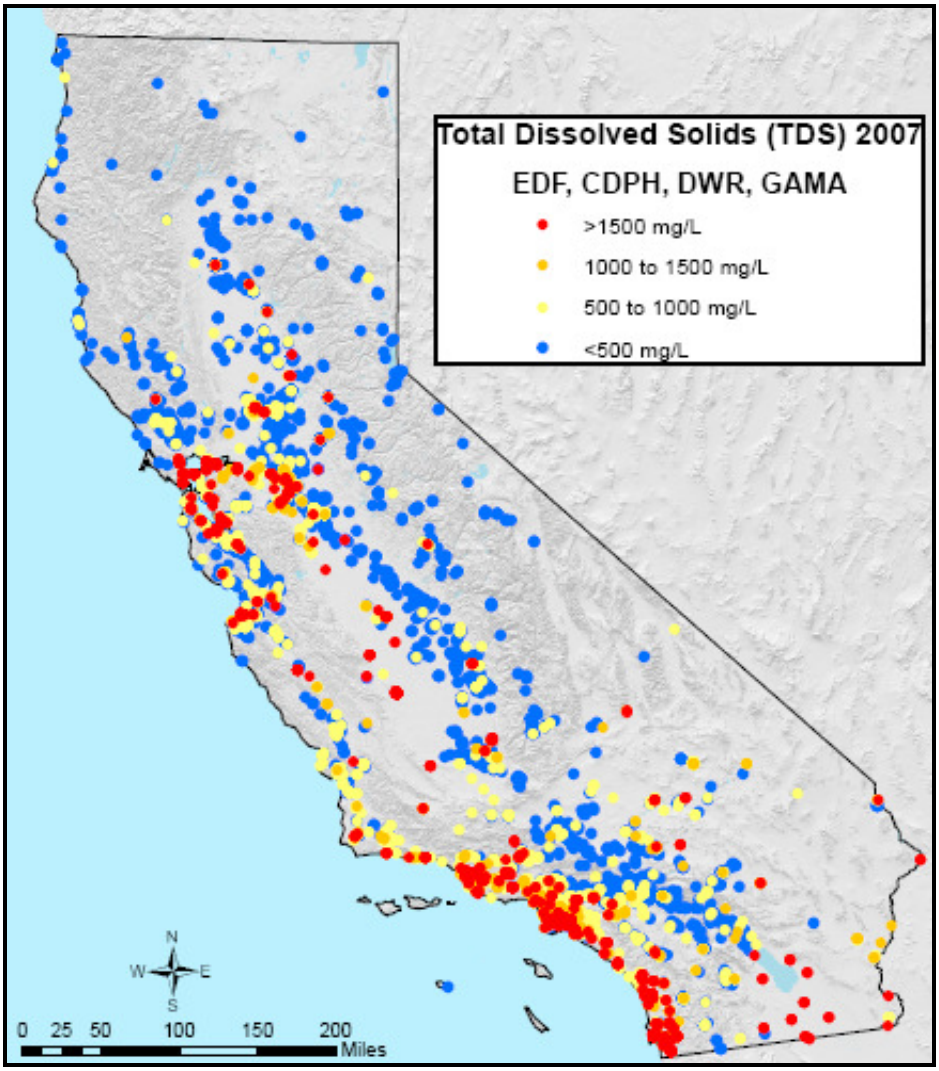
- Natural: Groundwater contains naturally-occurring salts from dissolving rocks and organic material. Some rocks dissolve very easily; groundwater in these areas can naturally be very high in salinity.

State Water Resources Control Board
Division of Water Quality
GAMA Program

Drinking Water Standards for Salinity

The California Department of Public Health (CDPH) has established EC and TDS secondary maximum contaminant level (SMCL) drinking water standards for public water supplies. SMCLs are ranges set by CDPH for taste and odor thresholds; for TDS, the recommended SMCL is 500 mg/L, and the upper SMCL is 1,000 mg/L. For EC, the recommended SMCL is 900 µS/cm, and the upper SMCL is 1,600 µS/cm. EC and TDS also have short-term SMCLs that are generally allowed only under rare circumstances (2,200 µS/cm and 1,500 mg/L, respectively).

A map of TDS in California's groundwater measured in 2007 is shown below. Specific areas with groundwater TDS concentrations above SMCLs are located along the southern coast, the Sacramento-San Joaquin Delta, the southern and western San Joaquin Valley, San Francisco Bay, and the Salton Sea area.



TDS in Groundwater, 2007
TDS concentrations using data from public supply wells (CDPH), environmental cleanup sites (SWRCB), Department of Water Resources (DWR), and the State Water Boards Groundwater Ambient Monitoring and Assessment (GAMA) Program. Red dots indicate wells where TDS concentrations are above short term public drinking water standards. Orange dots indicate wells where TDS concentrations are above upper limit public drinking water standards. Yellow dots indicate wells where TDS concentrations are above recommended public drinking water standards, and blue dots indicate wells below all public drinking water standards. Data source: GeoTracker GAMA.

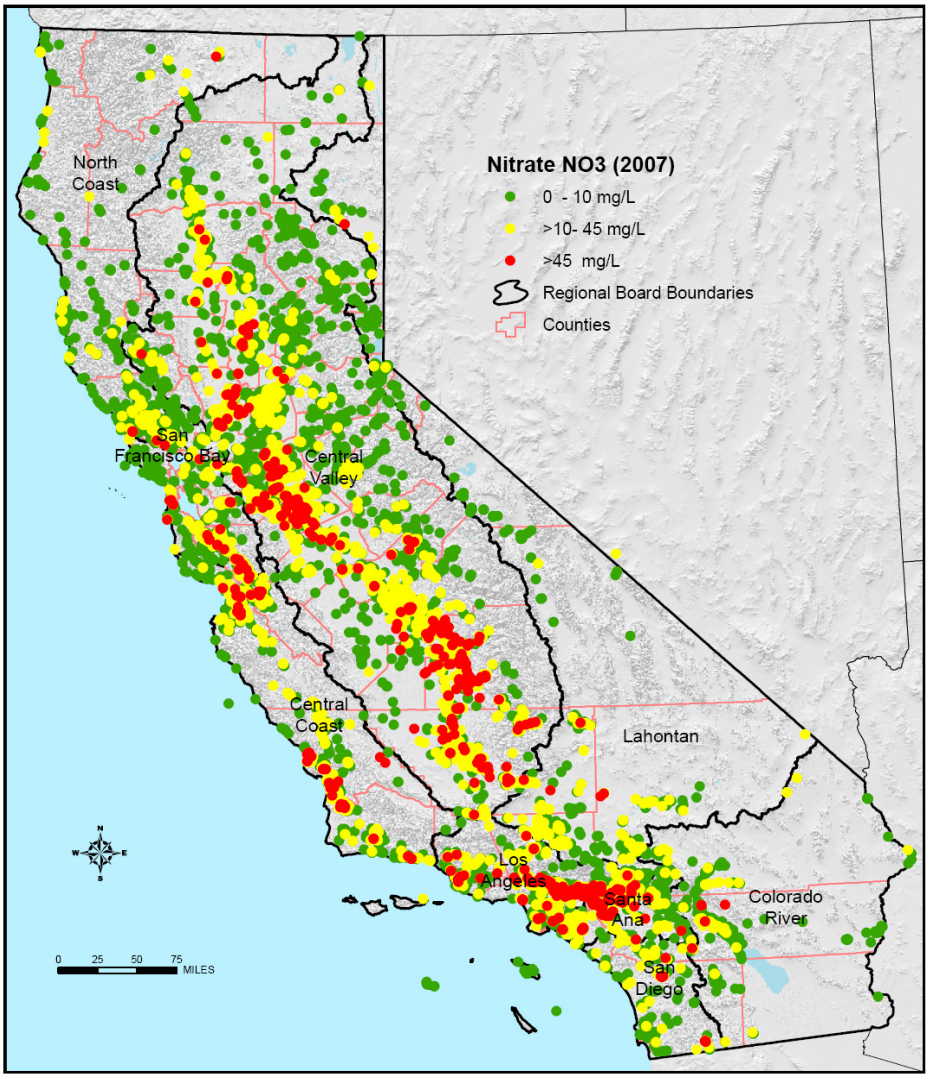
Revised March 2010

State Water Resources Control Board
Division of Water Quality
GAMA Program

Nitrate: A Unique Salt

Nitrate (NO_3^-) is formed naturally when nitrogen-containing organic compounds are broken down in the presence of oxygen. Nitrate is also produced in an industrial process during manufacture of synthetic fertilizers. High levels of nitrate in groundwater are associated with intense agricultural activity, septic systems, confined animal facilities, and wastewater treatment facilities. Nitrate is also one of the few salts that can be removed from water through a naturally occurring process (denitrification).

Nitrate is a health concern. Methemoglobinemia, or "blue baby syndrome," can affect infants when elevated nitrate levels in drinking water cause a decrease in the oxygen carrying capacity of blood. The current drinking water standard of 45 mg/L as NO_3 is specifically designed to protect infants. High levels of nitrate in drinking water may be unhealthy for pregnant women. Livestock can also be sensitive to high levels of nitrate in their drinking water.



Nitrate in Groundwater, 2007
Nitrate concentrations using data from public supply wells (CDPH), environmental monitoring wells (SWRCB), DWR, and GAMA. Red dots indicate wells with nitrate concentrations above public drinking water standards (>45 mg/L as NO_3); yellow dots show nitrate concentrations from 10 to 45 mg/L (as NO_3); green dots show concentrations of nitrate less than 10 mg/L (as NO_3). Data source: GeoTracker GAMA.

Revised March 2010

Water Softeners

Water with high concentrations of calcium and magnesium is referred to as 'hard water.' Hard water – which can clog pipes and reduce the lathering action of soaps – may be treated using a water softener that exchanges magnesium and calcium ions for sodium or potassium ions. In order for the water softener to function properly, the exchange resin must be periodically recharged using a highly saline brine. The brine used in the regeneration process is discharged to municipal sewage systems or a septic leachfield. Wide-spread use of water softeners has been known to significantly increase salinity levels in wastewater sent to water treatment facilities.

Seawater Intrusion

In some locations, groundwater overdraft (overpumping) has caused the natural groundwater gradient to reverse and has allowed seawater to intrude coastal aquifers that historically contained only fresh water. Seawater intrusion can ruin drinking water and irrigation wells, and render some areas unsuitable for continued agriculture. The Salinas groundwater basin, Santa Clara Valley (San Francisco Bay), and the Los Angeles basin have experienced significant seawater intrusion into drinking water aquifers. To prevent additional seawater intrusion, communities have installed subsurface barriers and injection wells to restore natural groundwater.

Salinity Challenges

Addressing salinity in California's waters is a challenge for California. Some generation of salt is unavoidable: public water works, industrial activities, food processors, and dairies are important parts of the economy and society – and can all increase salt loads to the State's waters. The following summarize efforts made to address salinity in California:

- The State's NDPES and WDR regulatory programs manage salt impacts to surface water and groundwater.
- Institution of preventative measures by local agencies, such as requiring more efficient water softeners and managing lawn fertilizer application.
- Reducing salt loads from imported irrigation water
- Development of technical advances in irrigated water and fertilizer application methods.
- Disposal of salts through brine lines, deep injection wells, lined landfills, and evaporation ponds.

BARRY BRANIN (Owner of a farm in the Los Osos area): Comments to the County Board of Supervisors, 10/25/11

15:21 I'm the most immediate neighbor to the new wastewater treatment plant site. I own 400 acres immediately north. We were probably of all the ag people the most likely user other than the person who you're taking part of his property, Mr. Giacomazi. I received the request for participation in this wastewater plant. I will tell you as a farmer the way the plant is designed – they use an oxidation ditch - they're not producing the water that would be quality enough that we dare put it on our crops. Mr. Edwards (previous speaker) mentioned the fact that the new runoff rules that are coming to all farmers says you're responsible for anything that runs off your property, so here, the County, in this process is asking us, the farmers, to accept water that is not equal to what our well water is, so we're receiving in essence a pollutant. The total dissolved solids that are in the water are not pinned down. They should not be greater than what the dissolved solids are from our well water because if we did it, we'd be polluting our property and therefore responsible for any runoff that would go into the bay. So this whole water quality issue is not defined enough that I could sign an agreement with the County. As I said we have 400 acres. We're farming heavily. There are two other immediate farmers in the area that are farming agriculture heavily. We use lots of water but I can not see that this agreement, this proposal made any common sense. I believe if there was a plant developed – if you used a plant instead of an outdated design of a wastewater treatment plant you're using that produces a low quality effluent and does not really do what it could do. There's a plant in Santa Paula that I wish I could get you to visit and it produces a water that comes out of that plant that percolates into the groundwater and the farmers can pump it and get – it's wonderful water. I've actually drunk the water that's coming out of the spigot at the end of the sewage treatment plant but we haven't even looked at that. We're using an old outmoded plant design that costs more to build, produces a dirty effluent and you're asking the farmers to take it on. There's no price - it just doesn't make any sense and I hope you'll spend some time to look into this further. There's been a lot of push. I was here the whole time when the process was changed and the whole wastewater treatment design of the plant is poor and that's why you didn't get participants.

June 5, 2011

State Water Resources Control Board 1001 I Street Sacramento, CA 95814
Via E-Mail to Charles R. Hoppin, Chair (smacali@waterboards.ca.gov)
Frances Spivy-Weber, Vice Chair (Ldouglas@waterboards.ca.gov)
Tam M. Doduc (Dbourgeois@waterboards.ca.gov)
Dwight P. Russell (Ldouglas@waterboards.ca.gov)

Re: Appeal of Waste Discharge Requirements for the Los Osos Water Recycling Facility (Order No.R3-2011-0001 & Draft MRP Order No. R3-2011-0001)

Honorable Board Members:

The Los Osos Sustainability Group (LOSG) is appealing the Waste Discharge Requirement for the Los Osos Water Recycling Facility (LOWRF) (a.k.a. the Los Osos Wastewater Project, LOWWP) issued by the Central Coast Regional Water Quality Control Board (CCRWQCB) May 5, 2011. We request that you deny a permit for Los Osos wastewater project until an alternative is identified through a subsequent EIR or EIS that will protect the Los Osos Valley Water Basin and high-value sensitive habitat. The current project does not mitigate for severe adverse impacts on seawater intrusion and environmentally sensitive habitat, including the Morro Bay National Estuary. It will also devastate the low to moderate income community of Los Osos due to its tremendous cost, which will, in turn, have severe environmental consequences by draining scarce resources necessary for cost-effective measures to preserve the water supply and habitat (See Addendum Attachment #27 for homeowner sewer and water costs). Because the current project does not avoid or minimize impacts, or identify the most cost-effective feasible alternative, it violates the CEQA, NEPA, and the Clean Water Act.

Additionally, we request that you do not approve a project until the Central Coast Regional Water Quality Control Board (CCRWQCB), State Water Resources Control Board (SWRCB), and other agencies responsible for protecting water sources commit to ensuring the sustainability of the basin. This requires your Board and other agencies to make sure a wastewater project is an integrated part of a comprehensive, water management plan in the Los Osos Basin, with the main objective to reverse rapidly accelerating seawater contamination in the very near future. For a wastewater project to be worth anything at all, it must be part of management program that prioritizes reversing seawater contamination through the most cost-effective strategies available, placing less emphasis on nitrates than in the past. Otherwise funding agencies, including the SWRCB, will be throwing away taxpayers' money on a wastewater project because seawater will destroy the basin for all beneficial uses, causing harm to vital protected habitat, and considerable future environmental impacts as water projects are constructed to supply imported and desalinated water.

A comprehensive basin-wide management program, integrating cost-effective management strategies (conservation, septic system management, salt and nutrient management, and stormwater runoff management strategies), will likely provide the most cost-effective way to preserve the

basin—as we explain. The basin can be a sustainable sole-source water supply if well-managed, with a wastewater project designed as part of a cost-effective overall water-quality, water-supply solution, with the focus on stopping seawater intrusion. The proposed project, however, is not cost-effective and will do more harm than good.

Your board and other agencies (e.g., the Department of Water Resources) emphasize the need for communities to avoid reliance on imported water, and you stress the vital role integrated water management plays in sustaining local supplies. Your Board and the CCRWQCB affirmed this commitment with the adoption of the Watershed Management Initiative and the subsequent implementation of a watershed management plan in the Salinas River Valley to address a range of water quality-water supply issues, including seawater intrusion.

Two of our members, Keith Wimer and Elaine Watson, petitioned your board last September to implement a similar plan for the Los Osos basin, but they received no response. As a result, our group filed a Public Records Request this April to find out what actions your Board has taken, and the results of any testing or analyses your Board has done or received to assess the problem. Despite the Public Records Act allowing 10 days for your Board to provide public records, we've received no records to date and have recently been told the records will not be provided until August 1, 2011.

With a comprehensive water management program for the basin, implemented with your help and focused on reversing seawater intrusion in the near future; your Board, the Community of Los Osos, and all stakeholders in the basin, will have the best—possibly the only—chance of preserving the basin as the sole-source of water for the area.

The proposed project should not be approved because it violates CEQA

and the Clean Water Act

CEQA Section 15020 requires each public agency to be "responsible for complying with CEQA…" and Section 15042 allows a Responsible Agency "…to refuse to approve a project in order to avoid direct or indirect environmental effects of that part of the project which the Responsible Agency would be called on to carry out or approve," The CCRWQCB and SWRCB are requiring the project to protect the beneficial uses of the ground and surface waters of the state, so your Boards have primary responsibility for ensuring the project avoids or minimizes adverse impacts on groundwater water and surface waters. Because the project fails to mitigate for adverse impacts on seawater intrusion and habitat--and does more harm than good to basin resources—your Board should deny the project.

CEQA Section 15064 (a)(2) & (b) requires a responsible agency (SWRCB) to "make a finding under Section 15091 for each significant effect... (and)… to "make a statement of overriding considerations under Section 15093 for the project" when necessary. CEQA Section 15092 (b) states that "…a public agency shall not decide to approve…a project for which an EIR was prepared unless either (1) The project as approved will not have a significant effect on the environment, or (2) The agency has (A) Eliminated or substantially lessened all significant effects on the environment where feasible as

shown in findings under Section 15091, and (B) Determined that any remaining significant effects on the environment found to be unavoidable under Section 15091 are acceptable due to overriding concerns as described in Section 15093." Because the project has significant unmitigated effects and the CCRWQCB did not make findings of overriding considerations, the SWRCB should deny the project.

CEQA Section 15064 (b) requires that agencies make findings using "…careful judgment … based to the extent possible on scientific and factual data." Section 15064 (f) (5) states that findings "… shall be based on substantial evidence in the record of the lead agency…" and adds that "…speculation…or evidence that is clearly inaccurate or erroneous, or evidence that is not credible shall not constitute substantial evidence." Thus, the lack of substantial evidence in the EIR, Coastal Development Permit (CDP), WDR, and other review documents that the project mitigates for adverse impacts on seawater intrusion (e.g., in the upper aquifer) and habitat (Willow and Los Osos Creeks) requires the SWRCB to find that the project does not mitigate for significant impacts--and to not approve the project.

CEQA Section 15126.4 (a) (1 & 2) requires EIRs to "describe feasible measures which could minimize significant adverse impacts, including where relevant, inefficient and unnecessary consumption of energy," and it states "Formulation of mitigation measures should not be deferred until some future time. However, measures may specify performance standards which would mitigate the significant effect of the project and which may be accomplished in more than one specified way," and it adds "Mitigations measures must be fully enforceable through permit conditions, agreements, or other legally binding instruments." The EIR failed to consider an adequate range of mitigation measures (e.g., options for Broderson leach fields), and several proposed measures defer mitigation (e.g., by deferring essential assessments and allowing programs to be developed). Further, key groundwater mitigations (e.g., Condition 5) lack specific performance objectives. These deficiencies are made worse in the WDR. Therefore, the SWRCB should deny the project.

CEQA Section 15021 (a-d) states that a public agency "should not approve a project as proposed if there are feasible alternatives or mitigation measures available that would substantially lessen any significant effects that the project would have on the environment," adding that "an agency may consider specific economic, environmental, legal, social, and technological factors…" when "deciding whether changes in a project are feasible", and recognizing that "a public agency has an obligation to balance a variety of public objectives, including economic, environmental, and social factors…" Section 15126.6 (a, b, & c) states "An EIR shall describe a range of reasonable alternatives to the project… which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives…" adding "…the discussion of alternatives shall focus on alternatives to the project or its location which are capable of avoiding or substantially lessening any significant effects of the project, even if these alternatives would impede to some degree the attainment of the project objectives…" Because the EIR and other project review documents do not consider feasible project alternatives that balance public objectives and would substantially reduce impacts (e.g., optimizing the present system with coordinated management programs and/or a mix of on-site and cluster systems), the SWRCB should not approve the project.

CEQA Section 15162 (a) (2&3) requires a subsequent EIR if

(2) Substantial changes occur with respect to the circumstances under which the project is undertaken which will require major revisions of the previous EIR or Negative Declaration due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects; or
(3) New information of substantial importance, which was not known and could not have been known with the exercise of reasonable diligence at the time the previous EIR was certified as complete or the Negative Declaration was adopted, shows any of the following:
(A) The project will have one or more significant effects not discussed in the previous EIR or negative declaration;
(B) Significant effects previously examined will be substantially more severe than shown in the previous EIR;
(C) Mitigation measures or alternatives previously found not to be feasible would in fact be feasible, and would substantially reduce one or more significant effects of the project, but the project proponents decline to adopt the mitigation measure or alternative; or (D) Mitigation measures or alternatives which are considerably different from those analyzed in the previous EIR would substantially reduce one or more significant effects on the environment, but the project proponents decline to adopt the mitigation measure or alternative.

CEQA Section 15162 (c) states

(c) Once a project has been approved, the lead agency's role in project approval is completed, unless further discretionary approval on that project is required. Information appearing after an approval does not require reopening of that approval. If after the project is approved, any of the conditions described in subdivision
(a) occurs, a subsequent EIR or negative declaration shall only be prepared by the public agency which grants the next discretionary approval for the project, if any. In this situation no other responsible agency shall grant an approval for the project until the subsequent EIR has been certified or subsequent negative declaration adopted.

Accelerating seawater intrusion, which came to light with the release of the *Los Osos Groundwater Basin Update* (May 4, 2010), substantially changed the baseline conditions of the basin and project making potential impacts substantially more severe, and causing potential impacts not addressed in the EIR (e.g., seawater intrusion in the upper aquifer with the project as purveyors make major shifts in pumping to the upper aquifer to address intrusion in the lower). (See Addendum Attachments #2 (Exhibit B) & #3, p. 2.) Other purveyor measures to address accelerating seawater intrusion (e.g., cooperative treatment of upper aquifer water for nitrates, and implementation of basin-wide conservation) provide project alternatives considerably different from those analyzed in the previous EIR that would substantially reduce project effects (e.g., nitrate treatment at the well, combined with basin-wide integrated management). Other new information, including a Water Environment Research Foundation (WERF) study showing septic system GHG emissions are half of what the EIR assumes, requires re-evaluation of the "no-project" alternative and systems using on-site alternatives, which substantially reduce impacts on seawater intrusion and energy use (See Addendum Attachment #30).

Finally, the Clean Water Act requires wastewater projects that receive federal funding to be the most cost-efficient feasible alternatives, e.g., 33 U.S.C. § 1292:

> *Any application for construction grants which includes wholly or in part such methods or systems shall, in accordance with guidelines published by the Administrator pursuant to subparagraph (C) of this paragraph, contain adequate data and analysis demonstrating such proposal to be, over the life of such works, the most cost efficient alternative to comply with sections 1311 or 1312 of this title, or the requirements of section 1281 of this title.*

The project should not be approved because severe adverse impacts on groundwater and high-value sensitive habitat are not mitigated

The project clearly fails to mitigate for severe impacts on seawater intrusion and habitat. The project will remove a major source of basin recharge from septic systems causing a reduction in recharge and major changes in recharge regimes. The EIR recognizes the potential adverse impacts on seawater intrusion, proposing primarily Broderson leach fields as mitigation. However, Broderson leach fields, if they work perfectly (which is far from certain) will restore only 448 AFY of the approximately 900 AFY of recharge removed. The County plans to test the leach fields for three years, but provides no back-up plan if they fail to perform. (See Addendum Attachment #33). The prior Los Osos wastewater project provided for multiple leach fields with harvest wells, in part, to provide redundancy and assure water levels were maintained to preserve flows. (See Addendum Attachment # 35). Harvest wells are specifically prohibited in the present project due to water quality concerns, and only one other leach field at Bay Ridge Estates percolating just 33 AFY is planned. (See the CDP "Condition of Approval 1-J" on the County LOWWP website and Addendum Attachment # 25, p. 10). Additional leach fields are not likely to be feasible in the urban area where they'd have to be located to restore flows.

The proposed project also fails to mitigate for adverse impacts on high value habitat, including Willow Creek, a protected riparian habitat, and Los Osos Creek, a federally-listed endangered steelhead habitat. (See Addendum Attachment # 20). The EIR estimates the project will reduce groundwater flows to Willow Creek Drainage by 400-500 AFY, and the EIR acknowledges that wetlands will be affected. (See Addendum Attachment #20, p. 9). Nevertheless, it states that flow reductions are "speculative" and it finds no significant impacts to habitat (see DEIR, Appendix D-2, p. 44). Willow Creek Drainage supplies Eto Lake, Los Osos Creek, and Morro Bay National Estuary, where it is also a State Marine Reserve (See Addendum Attachment # 20, pp. 9-14). Moreover, Spencer Harris, the project consultant providing most of the studies for the EIR groundwater analysis (Appendix D), testified at a County Planning Commission meeting on 6/30/09 that wetlands in the area would begin to dry up (See Addendum Attachment # 41, p. 23). The prior project provided leach fields to restore 358 AFY of water to Los Osos Creek. (See Addendum Attachment # 35, p.3).

The County Planning Commission and California Coastal Commission recognized deficiencies in project groundwater mitigations, adding several conditions to the Coastal Development Permit (CDP) to address concerns (Conditions 87, 88, 97, 99, 103, 108, and Special Condition 5). However, the conditions defer essential assessments (e.g., baseline flow measurements) and fail to identify specific and enforceable standards or measures to avoid or minimize impacts as required by CEQA. CDP Special Condition 5 (the "Los Osos Recycled Water Management Plan") for instance, which the Coastal Commission added to the CDP in June 2010, defers baseline flow assessments of Willow Creek, and fails to identify enforceable performance objectives or specific mechanisms to restore flows to Los Osos Creek (See Addendum Attachment #25, pp. 14 & 15). The prior project provided for two leach fields nearby to restore about 350 AFY of groundwater to Los Osos Creek. (See Addendum Attachment #35, p. 3). These leach fields require harvest wells to manage water levels (not allowed in this project) and the leach fields are likely not feasible. (See Addendum Attachment #35, p. 4)

Furthermore, accelerating seawater intrusion makes potential project impacts substantially more severe, and causes adverse impacts not addressed in the EIR. In May of 2010, *Los Osos Groundwater Basin Update* (Basin Update) showed seawater intrusion to be advancing 12 times faster than assumed in the EIR (700 feet per year rather than 50-60 feet per year) (See Addendum Attachment #2, Exhibit B). In four years, between 2005 and 2009, seawater moved inland over a half mile, twice as far as it had in the previous 20 years, contaminating much of the large lower aquifers, which supply over three-fourths of the water to the urban area. Seawater contamination now threatens to shut down (or is already shutting down) major supply wells, some in the central part of the freshwater basin. At the Palisades Well, for instance, chloride levels (an indicator of seawater intrusion) rose from 120 mg/l in 2005 to 360 mg/l in 2009. Water is not recommended for drinking at 250 mg/l, and Title 22 prohibits consumption at 500 mg/l.

A review of basin conditions by one of the foremost experts on the basin, Eugene Yates, concluded that accelerating seawater intrusion is an "extremely urgent" problem, requiring immediate action (See Addendum Attachment #3, p. 1). (Mr. Yates co-authored the study, on which the benefits of the wastewater project are based, *Simulated Effects of a Proposed Sewer Project on Nitrate Concentrations in the Los Osos Valley Groundwater Basin*, Yates and Williams, November 6, 2003.)

Mr. Yates recommends a conservation plan to reduce pumping 500 AFY within two years (beginning in June of 2010), in addition to shifts in pumping to the upper aquifer, as planned by purveyors. He warns, however, that shifts to address the critical intrusion problem, in conjunction with project impacts (removal of septic system recharge) can cause seawater intrusion in the upper aquifer. (See Addendum Attachment # 3, p. 2).

Shifts in pumping would remove up to 1000 AFY more water from the upper aquifer, in addition to the 900 AFY of septic system recharge removed with the project (over half of which recharges the upper aquifer)--with only 480 AFY of water returned via Broderson and Bayridge Estates leach fields (if they work perfectly). The EIR points out that the upper aquifer is only "relatively stable," subject to

seawater intrusion if water tables drop, and they will according to a 2009 basin yield evaluation as shown by reduced aquifer outflows (See Addendum Attachments #32, p.4.)

Mr. Yates also points out that increasing salt content in the domestic water supply from accelerating seawater intrusion could jeopardize a project recycling program by making the water undesirable for farmers. He confirms the viability of treating water for nitrates at the well, and he recommends further analysis of mitigation options given substantial changes in the project description and basin conditions after EIR certification. (See Addendum Attachment # 3, pp. 2 & 4).

A major flaw in the EIR, CDP, and WDR is a failure to address obvious problems with the project's main mitigation for groundwater impacts, Broderson leach fields. Mr. Yates January 2010 review states that the leach fields will not mitigate for reduced flows to bayside wetlands. (See Addendum Attachment # 24, p. 6).

Also, no mitigation is provided to avoid or minimize impacts on seawater intrusion and habitat when Broderson leach fields are being tested at 200 AFY for three years (per the FEIR)—or if they fail to perform. (See Addendum Attachment #33) Roger Briggs, Executive Officer of the CCRWQCB, expresses the latter concern in his DEIR comments:

> *The DElR explains that monitoring changes in groundwater levels down gradient of the Broderson site will assure that any changes "will remain less than significant." However, the DElR fails to present a mitigation plan describing the best methods to respond to incremental changes in groundwater levels that would allow for continued safe use of the disposal fields relative to potential destabilizing the hillside below the Broderson site, increasing liquefaction potential or limiting the amount of unsaturated soil available for effluent treatment.*
>
> *The DElR does not to (sic) provide discussion on mitigation for disposal design for Waste Water Treatment Plant Operations should monitoring data show that changes in the groundwater levels require a decreased disposal rate for the Broderson site. The EIR states that monitoring will occur to determine if the Broderson site could safely increase the level of disposal operations. However, no discussion is presented to state how the plant operations will be conducted if the Broderson site disposal rates must be decreased due to destabilization of the hillside below the disposal site. Since the Broderson site is a critical component of all four project alternatives, and because it needs to be designed to accept disposal year-round, including during the rainy season, the County should explain how disposal operations will be affected and what potential options will be available to replace any required reduction in disposal levels at Broderson.*
>
> *Water Board staff will evaluate the County's waste discharge application to ensure compliance with Basin Plan design criteria, siting criteria, disposal monitoring, and associated operations and management procedures for the proposed the (sic) Broderson site leach field system. Staff will consider incorporating requirements that are specific to the design and management of*

the proposed disposal system. (See Mr. Briggs letter, Pages 4 & 5, on the County LOWWP website FEIR and RTC. Pp. 3-42 to 3-43)

The FEIR's response to Mr. Brigg's, and others with similar concerns, is that the leach fields 1) have been tested, 2) more water can go to spray fields, 3) 46 AFY of recycled water storage allows some adjusting in disposal rates, 4) 160 AFY of conservation over 20 years provides a margin of safety, and 5) other leach fields can be installed. This response clearly does not explain how the proposed project will address the problem. Spray fields have been eliminated, other leach fields are not part of the project and are not likely to be feasible, the conservation program is not developed, and an initial study indicates water reduction targets won't be reached until 2019--so conservation will not mitigate for a reduction of 250 AFY of recharge (or disposal) as Broderson leach fields are tested--or the loss of 450 AFY of recharge if the leach fields don't work. Also, conservation requires purveyor cooperation which is not certain (e.g., to reduce pumping from seawater-impacted parts of the basin).

The CDP provides for a more aggressive conservation program than the EIR (Conditions 99 and 5b) (See Addendum Attachment #25, pp. 14 & 15, and the LOWWP CDP on the County LOWWP website). However, the question of purveyor cooperation makes benefits uncertain, the County has not shown a commitment to implementation, and the WDR fails to support the measures. Conditions 99 and 5b provide for $5 million to initiate indoor conservation measures within the prohibition zone to achieve the 50 gallons per capita per day (gpcd) target as soon as possible (See Addendum Attachment # 25, p. 15).

A 2009 CCRWQCB staff report, states the CCRWQCB can encourage "...stringent mandatory conservation programs in severely over drafted basins," but the WDR does not do so. Instead, the WDR states that staff will support efforts by water purveyors (See Attachment C, p. 2, and CCRWQCB Staff Report, Item 13, p. 19, May 5, 2011).

Los Osos water purveyors have been developing a basin management plan since 2008 to resolve water rights and address seawater intrusion through a cooperative agreement, as part of an adjudicated basin process (with the County one of the parties). The management plan was supposed to be finished in December of 2009, but is still not complete. Purveyors recently released a draft conservation study that does not include a scenario implementing Conditions 99 and 5b. The most aggressive scenario achieves the 50 gpcd target in 2019, four years after project start up. Further, all conservation scenarios in the draft plan require purveyor cooperation to implement and to achieve mitigation benefits (e.g., reduced pumping from seawater-impacted parts of the basin), and all scenarios have purveyor costs--so purveyors may not support all measures. Further, the County recently released a budget allotting $3 million to conservation--$2 million less than required by Conditions 99 and 5b (also $2 million less than allotted in SRF and USDA loan applications). (See Attachment A). The County also budgeted just $500,000 up front to develop the program although

Condition 5b states the $5 million will be used to "initiate water conservation measures…as soon as possible following CDP approval" (See Addendum Attachments #25, p. 15).

The recycled water program (Conditions 97 and 5a) is intended to mitigate for adverse impacts on seawater intrusion and habitat, but it is yet to be developed and lacks the specific performance standards necessary to ensure mitigations are enforceable. (See Addendum Attachments #25, pp.14 & 15). In fact, the program itself will have adverse impacts (direct, indirect, and cumulative), which have not been analyzed or mitigated, and feasible alternatives were not analyzed. The WDR does nothing to bring the measure into compliance with CEQA. It allows the recycling program to be developed in the future, without adequately considering impacts from salts or other contaminants, (e.g., emerging contaminants), and it allows the salt and nutrient management program to be developed through a stakeholder process, with indefinite timeframes and outcomes. (See WDR, Item 13, p. 7, May 5, 2011).

In his DEIR comments, Roger Briggs identifies a serious potential adverse impact from the recycled water program--salt build up—which is not adequately addressed in the FEIR. The new, more severe potential impacts due to accelerating seawater intrusion are not addressed at all in the WDR or other project documents. Mr. Briggs states:

> *Salt management is important in addressing the potential impacts for salt accumulation in groundwater aquifers. -The only discussion of salt management in Section 2.4 (Project Components) and Section 5.2 (Groundwater Resources - Cumulative Impacts) of the DEIR, is regarding saltwater intrusion. The DEIR does not discuss potential salt accumulation due to the continuous disposal of wastewater in a designated location, specifically, spray field irrigation at the Tonini property and at the leach field at the Broderson site. Salt buildup in upper groundwater aquifers is a common problem in the Central Coast Region due to a mixture of agricultural irrigation practices and land disposal of treated wastewater. Excessive salt build up in groundwater aquifers has the potential to render the aquifer useless for future agricultural or domestic supply water use…*
>
> *Section VIII.C.4 of the Central Coast Water Quality Control Plan (Basin Plan) discusses the need for salt management and improved salt management techniques. Some suggestions provided in Section VIII.C.4 of the Basin Plan include using wet weather storage reservoirs to dilute groundwater, improving the qualitylquantity of the groundwater aquifer. Also, this section discusses the use of drainage wells which divert rainwater to salt sinks in order to increase dilution.* (See Mr. Briggs letter, Pages 3 & 4, on the County LOWWP website *FEIR and RTC, p*p. 3-41 to 3-42*)*

The County responds to this comment in the FEIR by stating that the impacts are not significant because septic system discharge will have similar TDS levels. However, the FEIR does not (nor do the CDP or WDR) address specifically how the project mitigates for adverse impacts on Broderson leach fields, the upper aquifer, urban reuse sites, and agricultural reuse sites (farmland and aquifers).

Moreover, review documents do not address the increased severity of the problem with accelerating seawater intrusion.

The Basin Update provided average salt levels in the water supply, which the CCWQCB staff report for the WDR cites (See CCRWQCB Staff Report, Item 13, p. 22, May 5, 2011.) Total Dissolved Solids (TDS), an indicator of salt content, averaged 580 mg/l in May of 2011. The EIR assumed TDS in the water supply to be 420 mg/l, rising to 620 mg/l with household use before it enters the wastewater stream. This is based on *Fine Screening Report* estimates. (See Attachment B, p.1). This means the TDS of treated effluent as of May 2010 would be between 780 mg/l and 880 mg/l. (See Attachment B, p.2) The WDR estimates that the salt content of the upper aquifer averages 330 TDS, and the water pumped from farming aquifers averages 520 mg/l TDS (See Attachment B, p.2 and Addendum Attachment #20, p.2.). Thus, the treated effluent from the project will significantly degrade both water sources and threatens the viability of reuse programs.

Another project condition added to mitigate groundwater impacts is Condition 88, requiring the County to "evaluate and, where appropriate, assist property owners in the implementation of opportunities to re-use existing septic tank effluent disposal systems (e.g., leach fields) to filter and percolate stormwater runoff." (See CDP on SLO County LOWWP website). The condition is vague and not likely to provide significant benefits. This is because it is a voluntary program that will have costs for the homeowner. With the high cost of the sewer, participation is likely to be low. Also, the Yates and Williams 2003 study shows that over half of the rainwater falling on properties in the prohibition zone percolates to the groundwater under present conditions. (See Yates and Williams, 2003, "Past Project Document," SLO County LOWWP website). Because heavy rains will overwhelm the septic systems, sending rainwater to septic systems does not increase the volume of water percolating to aquifers, and the systems could result in pollution of ground or surface water (e.g., with overflows). The WDR and staff report indicate that the CCRWQCB will support repurposing septic systems, but it doesn't analyze specific benefits or set specific performance standards, so the WDR does not bring the measure into compliance with CEQA standards for mitigation. Further, low impact development strategies, such as rain gardens and vegetated swales, achieve more benefits with less energy use, by reducing water use for landscaping, and capturing and infiltrating rain that would normally run off during heavier rains.

For the above reasons, the project does not mitigate for severe potential adverse project impacts on seawater intrusion or habitat, nor does it use the most protective feasible options.

The project should not be approved because its benefits do not outweigh its adverse impacts

It is the responsibility of the Water Boards to assure the project achieves its basic goal of protecting the basin with the most cost-efficient feasible alternatives. Thus, the Boards must establish that the

project does more good than harm and justifies the adverse impacts on the environment. The evidence emerging from the LOWWP environmental review and permitting processes (including the WDR review) leads to only one reasonable conclusion: The proposed project's modest uncertain benefits do not justify its tremendous unavoidable adverse impacts---or its risks to the water supply and protected habitat (including Morro Bay National Estuary) (See Addendum Attachment # 20, pp. 7 & 8 for the estimated nitrate improvements over 30 years).

The facts show that seawater intrusion poses an imminent threat to resources, and the project can make the problem worse. (See Addendum Attachment #2 (Exhibit B) and Addendum Attachment # 3, p.2.) It also shows nitrates, the main focus of the project, pose no threat to the sustainability of the basin or Morro Bay National Estuary. (See Addendum Attachments #22 & 23). When the tremendous unavoidable environmental effects of installing 44 miles of pipeline with deep trenching is considered, e.g., 7.5 million tons of GHG's emissions from 3 million miles of vehicle trips (the equivalent of about six round trips to the moon)--along with the tremendous risks to environmental resources, which the project unsuccessfully attempts to address with over 60 mitigation measures/programs in the EIR and over 120 added conditions in the CDP—the evidence overwhelmingly supports the conclusion that the project's adverse impacts and risks far outweigh its benefits. (See the DEIR, pp. 2-35 to 2-45; the FEIR, pp. 4-1 to 4-49; the CDP, pp. 1-34; and Coastal Commission for the LOWWP, June 10, 2010, pp. 90-95--on the County LOWWP and Coastal Commission websites; also, see Addendum Attachment #15, p. 4 for vehicle trips).

The uncertainty and unacceptable risk of this project is clearly shown by the fact that key groundwater mitigations lack the specificity to be measurable and enforceable—suggesting that mitigation measures for the project are not feasible. Repeatedly, key measures defer monitoring and assessment needed to determine impacts, and they call for plans and programs yet to be developed, with no specific performance standards to gauge the success and benefits of the measures. In fact, the project itself lacks specific performance standards for either ground or surface water improvement (See Addendum Attachments #19).

The project's primary water quality objective is to "alleviate contamination, primarily nitrates…" Yet, review documents show that after 30 years of septic system use, nitrates, the only contaminant over Title 22 drinking water standards in the basin, remains less than 1 mg/l over standards (10.9 mg/l versus the standard of 10 mg/l) (See Addendum Attachments #20, pp. 7 & 8). Furthermore, the CCRWQCB staff report acknowledges nitrate levels have stabilized under present land use conditions, concurring with a 2005 study that levels have reached "equilibrium" (see CCRWQCB Staff Report, Item 13, pp. 20 & 21, May 5, 2011, and Attachment C, p.1). The EIR estimates the project will reduce average nitrate levels in the upper aquifer to 8.3 mg/l over next 30 years. (See Addendum Attachment #20, p. 7.) The project will not increase the beneficial use of the water in the foreseeable future. Local water purveyors, in fact, plan to treat the water for nitrates before it is pumped to customers to increase its beneficial use (See Addendum Attachment #2, p.5). Well treatment in Los

Osos provides a more cost-effective way to increase the water's beneficial use than a wastewater project.

It must also be noted that the results of nitrate testing/monitoring have not been published since 2006, despite CCWQCB Resolution 83-13 (the same resolution that bans septic systems) requiring it. Average nitrate levels may currently be below 10 mg/l, meeting CCWQCB basin objectives.

Moreover, during the review process, no credible evidence was provided that septic systems are harming the estuary or estuarine systems—or that a costly centralized wastewater project will improve estuary water quality. The WDR and other review documents only suggest septic systems are harming the estuary, citing insubstantial evidence to support the proposed project, such as the Kitts study (See WDR Order No. R3-2011-0001, p. 5, May 5, 2011). This study found, through DNA testing, that two seeps along the estuary contained human coliforms (e-coli). However, it also showed that human e-coli (from the seeps and other sources) was a fraction of 1% of e-coli loading in the estuary and was not present in oyster beds. At an LOCSD presentation, Dr. Kitts said e-coli samples at one site appeared to be from just one source, and he repeatedly said the study should not be used to support a wastewater project. The WDR acknowledges that nitrate contamination of Los Osos Creek is from surface runoff, and it cites no evidence that nitrates from septic systems are contaminating Morro Bay Estuary or estuarine systems (See WDR Order No. R3-2011-0001, p. 5, May 5, 2011). Studies support that nitrate levels in the estuary near Los Osos are low. (See Addendum Attachments # 23, pp. 11-13).

The project should not be approved because feasible alternatives, which would substantially reduce impacts, have not been evaluated

CEQA (Section 15021) states that an agency should not approve a project if there are "…feasible alternatives or mitigation measures available that would substantially lessen any significant effects that the project would have on the environment."

An integrated watershed/basin management plan applying comprehensive conservation measures, salt and nutrient management, septic system management, and low impact development (stormwater management) programs—in conjunction with treatment of nitrates at the well—is one alternative that has not been considered that would achieve the objectives of the project—"alleviate contamination—primarily nitates…" and ensure resource sustainability. It would virtually eliminate unavoidable environmental impacts from construction, as well as the adverse impacts and risks to the basin and protected habitat from reduced groundwater flows. It would also minimize costs and socio-economic impacts. Thus, it has the potential to provide maximum overall benefits for the lowest costs, and should be evaluated.

"Optimizing" the present system is an alternative USDA funding policy recommends, but it was not reviewed. One piece of evidence to support this alternative is that the CCRWQCB and SWRCB policies support management programs and integrated watershed planning. Despite this emphasis, neither

has pursued management options in the basin. The CCRWQCB ordered the County to develop a septic system management plan about the time it ordered elimination of septic systems in the 1980's, but never enforced the order. The Boards have also failed to support a comprehensive management plan for the basin as provided in the Local Coastal Plan. As mentioned, neither board responded to the request of two of our members to implement a watershed management plan for the Los Osos basin as the Boards did in the Salinas River Valley to address water quality-supply issues, and they have not actively supported conservation separate from the wastewater project process (see Addendum Attachment # 29 for the LCP provision for a basin-wide plan in cooperation with the County).

The draft conservation plan sponsored by Los Osos purveyors indicates that substantial water use reductions can be achieved in the basin with basic conservation measures--enough to potentially reverse seawater intrusion without the wastewater project.

Permit documents and agency officials have claimed that a centralized project like the approved project is necessary to stop seawater intrusion and protect habitat (including Morro Bay National Estuary). However, this claim is not supported by substantial evidence emerging during the review. The evidence, instead, supports that better basin management, with integrated programs and planning, would reverse seawater intrusion and reduce nitrates, with virtually no risk to the basin, vital habitat, or scarce public funding.

This alternative, would involve maintaining septic systems in place, with upgrades as needed. The approach (i.e., decentralized wastewater treatment with centralized management) was not considered in the EIR, but it is supported by the 2010 EPA guidelines for septic system use near Chesapeake Bay (See Addendum Attachment # 31, e.g., pp. 6-3 to 6-5). The guidelines set discharge requirements for septic systems according to proximity to the bay. However, Chesapeake Bay shows signs of nitrate contamination. No credible evidence has been presented that nitrates from septic systems are causing pollution of the estuary.

Even without septic system upgrades—with just a nitrate management plan focused on reducing nitrates from sources other than septic systems—significant improvements in water quality can be achieved. This is supported by Yates and Williams 2003 study (which provides the basis for estimated nitrate reductions from the proposed project). Tables 4 and 9 show that about 70% of nitrate loading in the upper aquifer is from sources other than septic systems (see Yates and Williams, 2003, "Past Project Document," SLO County LOWWP website, and DEIR Appendix C of Appendix D-2). The tables also show about as much rainwater percolates to the aquifer on-site in the prohibition zone as septic system return flows. The relatively high rates of dilution in the basin—along with the natural treatment of nitrates in the soil--is the reason that nitrate levels have stabilized in the upper aquifer at less than one milligram per liter over Title 22 standards. The Yates and Williams' data further shows that about half the rain falling on medium density neighborhoods in the prohibition zone leaves the property as runoff. This supports a conclusion that on-site low-impact development (LID)

strategies, implemented as part of integrated management program, to capture and percolate more rainwater on-site, can reduce nitrate concentrations—potentially bringing upper aquifer recharge to within Title 22 standards (10 mg/l). The study also points out that the average 10.9 mg/l of nitrates in water recharging the upper aquifer is a basin-wide average. In fact, water percolating from prohibition zone neighborhoods has lower concentrations of nitrates than water percolating from neighborhoods outside the prohibition zone (e.g., low-density neighborhoods), which are not required to eliminate septic systems. Thus, failing to include all property owners in the basin in nitrate management programs is not justifiable by the science.

In fact, centralized septic system and nitrate management, integrated with LID-stormwater programs and conservation, will reduce nitrate concentrations in the basin and may reverse seawater intrusion—providing a much less environmentally harmful and risky alternative for sustaining the water supply. It would also be a much more cost-effective, equitable, and scientifically supportable way to address water quality-supply issues since nitrate loading and reversing seawater intrusion requires a coordinated stakeholder effort basin-wide. A very expensive wastewater project, with many known and unknown impacts—and a very high price tag, sure to go much higher—will only make an integrated, cost-effective solution much more difficult to achieve. For one thing, it will make it more difficult for water purveyors to pass the costs for conservation and shifts in pumping on to customers and could slow the implementation of these important management measures.

Further Discussion

Please see further discussion of impacts not addressed and other CEQA/NEPA violations in letters sent to the SWRCB objecting to SRF funding for the LOWWP, and sent to CCRWQCB objecting to the WDR, on behalf of Citizens for a Sustainable Community, on February 26, 2011 and March 11, 2011, respectively. Also see the Addendum (large comment letter) submitted by Angel Law for further discussion of impacts the project has not addressed and feasible alternatives not considered (http://www.swrcb.ca.gov/centralcoast/board_info/agendas/2011/may/Item_13/index.shtml).

Conclusion

The proposed project and project review-approval process and documents, including the WDR, do not analyze or mitigate severe adverse impacts on the Los Osos water basin and high-value environmentally sensitive habitat, including Morro Bay National Estuary. The documents and process also do not consider options and alternatives that can substantially reduce adverse impacts and risks to vital resources. CEQA requires agencies responsible for approving the project to make findings on impacts based on careful review of substantial information, and it allows agencies to not approve a project when it fails to mitigate impacts or the EIR fails to consider alternatives that can substantially

reduce project impacts. CEQA also requires responsible agencies to circulate a subsequent EIR when project conditions change substantially, causing substantial new impacts and opportunities to reduce impacts. The SWRCB and CCRWQCB have the primary responsibility for making sure the project (which the agencies are requiring) ensures the sustainability of the resource and dependent resources. The LOWWP review and permitting processes did not mitigate for serious impacts or considered more protective feasible alternatives—and the project will do more harm than good. Therefore, the SWRCB should not approve this project, and instead should issue a subsequent EIR to ensure the most protective, cost-effective solution for sustaining the water basin is implemented. Also, because the CCRWQCB and SWRCB are responsible for protecting and preserving threatened water sources, and recognize the importance of integrated, watershed management in such efforts; the CCRWQCB and SWRCB should commit to ensuring that a Los Osos wastewater project is part of an integrated management solution, designed to reverse seawater intrusion in the near future and reduce contamination from all sources as cost-effectively as possible.

Incorporate by reference

We incorporate by reference all comments and materials submitted to SLO County and Responsible Agencies that support this appeal, an SEIR or EIS for the project, and agency actions to ensure the sustainability of the Los Osos basin with cost-effective, integrated management and planning—including the letters/objections and addendum submitted by Angel Law to the SWRCB and CCRWQCB referred to in "Further Discussion" above.

We look forward to your response.

Sincerely.

Larry Raio

Chuck Cesena

Keith Wimer

Los Osos Sustainability Group (LOSG)

Attachments and References

1. The cited documents labeled "Attachments A-C" are attached to this appeal.
2. The cited documents labeled "Addendum Attachment #1-#42" are included in the WDR appeal submitted to the CCRWQCB by Angel Law, available on line at the CCRWQCB website: http://www.swrcb.ca.gov/centralcoast/board_info/agendas/2011/may/Item_13/index.shtml
3. Other cited documents are available at the websites identified in citations.

Alternative projects are more environmentally protective and cost-effective than the proposed project and should be reviewed and included in the design-build process

A centralized STEP project

Description/Benefits: A STEP alternative passed through the Fine Screening and EIR as a viable alternative, but was found to be less environmentally preferable based on biased assumptions (see Attachment 11). In fact, the STEP alternative has significant environmental and economic benefits over the proposed conventional gravity system. This is largely because its sealed, small diameter piping is much less costly and disruptive to install and because the technology virtually eliminates I/I and related impacts and costs (overflows, pollution, and expensive system repairs and upgrades to reduce overflows) (see Attachment 21). Additionally, STEP/STEG technology allows remote monitoring of tanks and pressurized lines to identify and repair problems quickly; and the shallower, smaller pipes allow less costly repairs. The system also reduces biosolids and related treatment and disposal costs and impacts (Biosolids are broken down in tanks by more than 50% via energy-free natural processes.); and STEP/STEG accommodates conservation flows without the need for redesign or additional maintenance (required by the proposed project). [Note: Intensive conservation is critical to reversing seawater intrusion and basin sustainability (see Attachment 3, e.g., pp.1 &3 and Attachment 4, p.2). Moreover, greater levels of conservation will occur naturally in the future with development of more water-efficient technologies and changing attitudes and policies. The rising cost of water and sewer fees tied to water use will drive use down as well.]

Representatives from local chapters of the Surfrider Foundation and Sierra Club, members of the LOSG, members of the public, and experts such as Dana Ripley of Ripley Pacific, documented the environmental superiority and greater cost-effectiveness of the STEP alternative during the review process; however, flaws in the process (e.g., bias and inaccurate assumptions) resulted in the STEP project never receiving full credit for its environmental benefits and cost savings (see Attachments 11 & 12).

The assumption that Broderson leach field disposal had to be part of any project is just one way STEP was penalized during the process. The Ripley Pacific plan developed for Los Osos in 2006 (available on the County LOWWP website) provided for 100% ag reuse, and did not require leach field disposal (similar to the LOSG plan). Combined with the Los Osos Sustainability Group (LOSG) or SLO Greenbuild plans (which emphasize water-use efficiency), the Ripley Plan could eliminate seawater intrusion, while requiring fewer ag reuse sites, allowing full reuse of recycled water over the basin (see Attachment 3, p. 5, Attachment 5, Attachment 11, p.2, and Attachment 26). This combination would also allow less recycled water storage and less pumping and treatment.

Costs, disagreement with project cost estimates, and why it should be included in the design-build process: The flawed LOWWP review process has prevented the public and decision makers from knowing the full potential of the STEP project to benefit the environment, reduce costs, and address concerns raised in the review process (e.g., on-lot impacts). Thus, requiring the design-build process for the collection system (and all project components), with the STEP team invited to compete, is essential to identifying the most cost-effective option (also see note at the end of this analysis).

Specific solutions to on-lot concerns could be addressed with use of existing tanks, shared tanks, and/or STEG (gravity units), while combining a STEP project with the LOSG plan would maximize seawater intrusion/environmental benefits and lower life cycle costs.

Because a STEP project has much lower construction costs—and because STEP avoids expensive repairs and upgrades required to manage I/I avoiding overflows and pollution of the National Estuary; STEP should have been credited with lower—rather than higher—life cycled costs (see Attachment 11). Dana Ripley of Ripley Pacific said at the Coastal Commission hearing on June 11, 2010, that STEP capital costs should be at least $50 million less than the proposed $180-$190 million project, with firm caps on costs (see Attachment 12, p.2). Also, the STEP design-build team that participated in qualifying interviews guaranteed significantly lower costs than competing gravity projects. Finally, combining the STEP alternative with the LOSG plan could produce a project that reverses seawater intrusion for $40-50 million less than the proposed project (see Attachment 5).

A decentralized treatment option

Description: The County retained Lombardo Associates, Inc. to provide designs and cost estimates for the alternatives review (see TM "Decentralized Collection" on the County LOWWP website; also see Attachment 9). He provided two scenarios using STEP/STEG technology, the least costly of which is Scenario 2 with non-residential reuse. This alternative is comprised of two cluster systems with small underground wetland Nitrex treatment systems at the Mid-town site and at a large undeveloped property on the east side of the prohibition zone, used as the staging site for the prior project. Scenario 2 also includes urban reuse at large sites (e.g., schools) and disposal/recharge at several drainfields within the prohibition zone. The Lombardo, Inc. plans included all on-lot costs (so homeowners would not pay on-lot costs separately as with the proposed project) and it includes all design costs. Substituting the LOSG sustainable basin plan proposal for the disposal/recharge component of the Lombardo Scenario 2 plan reduces project size and costs by maximizing water-use efficiency and eliminating drainfields (see Attachment 9, pp. 2-6). The LOSG plan would require adding more recycled water storage, e.g., at one or both treatment sites and/or the Giacomazzi site possibly as a constructed wetland. As with every project using STEP/STEG technology, biosolids are greatly reduced.

Benefits: Scenario 2 would have significant environmental and cost benefits over the proposed project. Because treatment occurs closer to the wastewater source, a decentralized project greatly reduces energy use and pumping costs, in addition to pipeline construction costs and impacts. Scenario 2 uses 95% STEG (gravity) units Therefore, it will have very low energy use/GHG production compared to other community systems (see Attachment 9, pp. 1 & 4; Attachment 10, p. 3; Attachment 15). Significant use of STEG systems also lowers electrical connection costs and other O & M costs. Scenario 2 includes on-lot costs for homeowners (estimated to be from $1500 to $10,000) (see Attachment 27, p. 1), so it also reduces overall costs for homeowners. Use of shared tanks, as the TM suggests, further reduces on-lot impact-cost concerns. Treatment with underground wetland systems provide attractive community spaces addressing community acceptance issues, and the Lombard Associates' Nitrex systems is a proven technology that reduces nitrogen to very low levels (see Attachment 9, pp. 7, 8, 10).

Combining Scenario 2 with the LOSG plan avoids use of Broderson leach fields and drainfield adding further environmental and cost benefits, e.g., the potential to reverse seawater intrusion and fully

restore flows to sensitive habitats. Installing a drainfield instead of added storage at the eastern treatment site of Scenario 2 may provide a way to maintain these flows. (This is an unmitigated and unfunded impact with the current project). The Decentralized TM states that treated water from the proposed Nitrex treatment systems is suitable to augment flows to habitat (see Attachment 9, pp. 7 & 10).

Costs and disagreement with project cost assumptions: The cost estimate for Scenario 2 in the decentralized TM is $170 million. However, Pio Lombardo, a nationally recognized leader in the design and installation of decentralized projects, disagrees with assumptions in the Fine Screening and TM's. He estimates removing the assumptions will bring costs down by $15 million to $17.3 million (see Attachment 9, pp. 6-9). This leaves costs of **$152.7 -$155** million. Substituting the LOSG sustainable basin plan for the drainfield disposal/recharge component of Scenario 2, reduces land costs for this option by about $12 million. Reducing the 30% construction contingency to 10% (equivalent to the contingency used for the current project), and deducting the escalation factor of 18%; reduces cost another $5 million, leaving **total project costs of $136 million to $138 million**.

The Mid-town property (one of the proposed treatment sites) has already been purchased, and the property for the second treatment site would be covered by the $3.5 million estimate for property in the TM. The cost of the Giacomazzi site (about $1.5 million) is covered by the remaining $1.8 million for drainfield land expense (i.e., $13.8 - $12 million). (Purchasing the Giacomazzi site allows it to be used for recycled water storage and/or solids processing.) Recycled water lines (e.g., to ag reuse sites and the Bayridge leach field), along with additional water storage required by the LOSG plan, are offset by drainfield/distribution costs savings (see Attachments 9, pp. 2-4, and Attachment 10). All design and on-lot costs are included in TM project costs (i.e., $1,500 to over $10,000) (see Attachment 27, e.g. p. 2). The costs for ag exchange wells and additional measures to restore flows to Willow Creek and Los Osos Creek are not included in this or the proposed project (for comparison). However, as noted above, installing a drainfield at the eastern treatment site of this alternative, instead of storage, may mitigate for reduced flows to the habitat at no additional cost.

Adding $5-7 million for the water use efficiency component of the Los Osos Sustainability Group (LOSG) plan (Attachment 5) provides a project alternative that could reverse seawater intrusion for under **$145 million**, and costs are likely to be substantially less in a competitive design-build process (see note at end of this analysis). Also, maximizing funding for the LOSG through rebates, grants, and innovative funding strategies could substantially reduce costs. SLO Greenbuild has offered to administer an integrated water-use efficiency plan and apply for grants (see Attachments 26, p. 2). The above estimates indicate project costs ate **at least $35 million less** than current project costs, and **O & M is $1 million less annually** (according to the TM) (see Attachments 9, p.4 and Attachment 10, p. 3). Thus, life-cycle costs are likely to be much lower than the proposed system.

Why the option should be reviewed and included in a design-build process: This alternative was not reviewed adequately or fairly, in part because the LOSG plan was not reviewed and considered although it is recommended and considered feasible by experts (see Attachment 3, pp. 5& 6, Attachments 4 & 6). The rough estimates above show this option could substantially reduce potential adverse project impacts and project costs, while doing much more to ensure the sustainability of environmental, social, and economic systems. Reduced impacts from greatly reduced energy use and the potential for very low life-cycle costs are particularly significant. Also, the Lombardo Associates'

Nitrex treatment system reduces nitrates to about 3 mg/l, under half the nitrate level of the proposed project (see Attachment 31, p.18) With solar power or wind generation added to the system, along with credit awarded for reduced energy use with the LOSG plan, the project could potentially be carbon neutral and a model of sustainable water-wastewater project design and management in the state. (This is also true of the project below and may be true for the STEP project above.)

A phased decentralized alternative

Description: This alternative is basically the decentralized project above installed in phases, with the first phase focused on properties near the estuary and in high groundwater areas (e.g., about 1000 of 4800 total properties), and the second phase implemented as needed depending upon the water quality benefits of the first project and future conditions in the basin. The first phase would be implemented with the LOSG sustainable basin plan, and include centrally managed septic system and salt & nutrient management plans (e.g., to ensure septic systems left in place are maintained and functioning to standards). The project may also include individual on-site systems where needed and cost-effective (e.g., at schools). One treatment facility would be on the Mid-town site as proposed in the decentralized TM. A nearby constructed wetland/finishing pond could be designed for passive recreation as a community amenity. Giacomazzi would not be needed unless it is used for storage, or it might be purchased for future expansion and storage. Reuse of recycled water (150-250 AFY) would focus on urban reuse and habitat support, so recycled water pipelines to the eastern side of the community would not be needed initially. Thus, mitigating for reduced groundwater flows to Willow Creek and Los Osos Creek would not be an issue because most septic systems on the eastern side of the community would be left in place. On-going water quality/seawater intrusion monitoring and assessments would determine if future project phases are needed.

Benefits: This option takes a precautionary approach to basin management recognizing that the urgent seawater intrusion problem and related uncertainties are critical factors in decision making, along with the potential adverse impacts on valuable environmentally sensitive habitat and endangered species. This project is much less likely to result in unintended consequences and harm to resources than a centralized project, while it addresses the most serious concerns, elevated nitrates (The project would manage nitrates from all sources.), septic systems in contact with groundwater, potential contamination of the estuary, and related health and safety concerns. Thus, it minimizes impacts and uncertainties, while maximizing water quality benefits.

Furthermore, it provides protection from overflows that might harm the estuary. Additional benefits from combining the Lombard Associates Scenario 2 with the LOSG plan are that an integrated plan emphasizing water use efficiency, with stormwater management (low impact development or LID) and xeriscape, will reduce nitrate levels in the groundwater by reducing nitrate loading and increasing dilution, while also increasing the vadose zone (dry zone) increasing natural soil treatment (for the septic systems left in place) and addressing high groundwater issues. Eugene Yates confirms these benefits in a review of the project's water management strategies (see Attachment 3, p.2). Basin-wide septic system and salt-nutrient management plans (as recommended by the LOSG) will also reduce nitrate contamination outside of the prohibition zone (see Attachment 5). The 2003 Yates and Williams study entitled *Simulated Effects of a Proposed Sewer Project on Nitrate Concentrations in the Los Osos Groundwater Basin* indicates that more than half the nitrates enter the groundwater are from sources outside of the prohibition zone and the water percolating to the groundwater from properties outside

of the prohibition zone (e.g., low density residential properties, horse farms, and cropland) has higher concentrations of nitrates than the medium density properties within the prohibition zone (see the 2003 Yates and Williams study on the LOWWP website, Table 4).

This precautionary, integrated management approach will likely reduce nitrates in the upper aquifer effectively, while fully addressing the more critical concern, seawater intrusion, and not jeopardizing critical habitat. The project also creates an attractive community space at the Mid-town treatment site and it would allow preservation of the entire Broderson site ensuring full compensation for any impacts on ESHA.

Costs: Based on estimates in the decentralized TM and above, **costs would be less than half current capital project costs (i.e., under $ 90 million)**, which would include adequate funding for the LOSG plan components for the project. A small general benefit assessment would extend water-use efficiency, septic system, and salt & nutrient management programs basin-wide (as recommended by the LOSG).

Why the option should be reviewed and included in a design-build process: This option provides the greatest overall benefit to the basin, at well under $100 million, very close to community affordability levels, while maximizing benefits and reducing risks to valuable environmental resources and scarce public funding. The option requires a waiver or modification of the Waste Discharge Requirement (WDR) from Regional Water Board to allow some septic systems to remain in place within the prohibition zone, but the overall benefits of the option warrant such waiver. Benefits predicted from the currently-proposed wastewater project are modest and long-term at best—while its potential impacts on the basin and valuable habitat, along with its tremendous costs, place vital natural resources and the community at risk. Many families will experience extreme financial hardship with the current project, and/or be driven from the community, for a project that could do more harm than good. **This option is likely be the best way to assure and promote environmental, social, and community sustainability.**

Summary of Benefits from a Phased Decentralized Project:

1. Will maximize benefits and minimize environmental, social, and economic impacts and risk to resources.
2. Will potentially reduce nitrate loading as much or more than the proposed system by reducing nitrates from all sources in a variety of ways.
3. Will potentially reverse seawater intrusion.
4. Will address concerns about septic system effluent in contact with groundwater and septic system pollutants entering the estuary
5. Will maintain the recharge regime of the basin in most areas, minimizing negative impacts on seawater intrusion and habitat from changes in groundwater flows.
6. Will avoid overflows of raw sewage and contamination to the estuary, inevitable with the proposed 85% conventional gravity system.
7. Will reduce the need for social and economic mitigations, also contingency planning.
8. Will greatly reduce construction impacts and costs (e.g., for road repair, impacts on ESHA, and archeological impacts).
9. Will reduce O&M impacts and costs (e.g., reduce pumping, GHG's, and energy use).
10. Will reduce system vulnerability to earthquakes (e.g., liquefaction, major shut downs, repairs, and replacements) including health and safety risks.
11. Will provide as many or more jobs for construction and O&M, including green jobs (e.g., water auditors).

(<u>Note:</u> Further review of the above options/alternatives and allowing teams that represent alternative technologies and approaches to compete in a design-build process is essential to determining the most cost-effective, protective alternative. Because bias has been shown in the County process, future reviews and the design-build process must be conducted and/or closely overseen by a neutral third party. We recommend that the Design-build Institute of American conduct the design-build process. Additionally, it is important to note that the LOSG has requested review of these options/alternatives many times, pointing out problems with the review, at every level of the process. The increasingly critical seawater intrusion problem and escalating project costs, along with other emerging information, have made review of the above options/alternatives (and other viable options not reviewed or not adequately reviewed), along with use of the design-build process for every project component, even more crucial for informed decision making.)

LOWWP TM: Decentralized Treatment Final, Oct. 2008; Task 3: Cost Estimates for Decentralized Scenarios

3. Type 3 – Existing septic tank in back yard to be abandoned and new STEP/STEG tank placed in front yard.

4. Type 4 – Existing septic tank in back yard to be abandoned and new STEP/STEG tank placed in front yard. Grade is such that a grinder pump is to be installed in the back yard to pump up to a STEP/STEG tank located in the front yard.

The distribution of each type of lot, as reported in the Fine Screening Analysis is as follows:

- Type 1 – 7.5%
- Type 2 – 67.5%
- Type 3 – 20.0%
- Type 4 – 5.0%

Estimates of the number of STEP systems required in each zone were made in the Task 2 TM. All other parcels were assumed to have STEG systems. The above distribution was used to determine the number of each type of STEP and STEG systems. The final individual lot quantities are presented in Table 2-1. The quantities for intercepting sewers, treatment and dispersal are the same as presented in the Task 2 TM.

Table 2-1: Scenarios Quantities for Wastewater Collection

Item Description	Type 1 STEG Conn.	Type 2 STEG Conn.	Type 3 STEG Conn.	Type 4 STEG Conn.	Number of STEG Conn.	Type 1 STEP Conn.	Type 2 STEP Conn.	Type 3 STEP Conn.	Type 4 STEP Conn.	Number of STEP Systems	Total Number of Systems
Units	EA	EA	EA	EA		EA	EA	EA	EA		
Scenario 1 Quantities	341	3,073	911	228	4,553	16	146	43	11	216	4,769
Scenario 2 Quantities	339	3,051	904	226	4,520	19	168	50	12	249	4,769

Item Description	Pressure Sewers / Force Mains	4" Gravity Sewer	Pocket Pump Station	Duplex Pump Station	Triplex Pump Station
Units	LF	LF	EA	EA	EA
Scenario 1 Quantities	24,900	221,000	4	2	0
Scenario 2 Quantities	26,100	220,100	2	2	1

95% gravity – only 249 units using pumps

Other quantities associated with the collection, treatment and dispersal systems are listed in Tables 2-2 and 2-3. Quantities are included for the option of returning water to the individual properties for reuse and/or dispersal.

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Table 4-4: Construction Costs – Scenario 2, without Residential Reuse

Item No	Item Description	Quantity	Units	Unit Cost Low	Unit Cost High	Total Cost Low	Total Cost High
	Collection System						
1	Mobilization/Demobilization	1	EA	5%			$2,843,000
2	Type 1 STEG Connection	339	EA	$ 3,850	$ 3,850	$ 1,306,000	$ 1,306,000
3	Type 2 STEG Connection	3,051	EA	$ 3,850	$ 3,850	$ 11,747,000	$ 11,747,000
4	Type 3 STEG Connection	904	EA	$ 5,445	$ 5,445	$ 4,923,000	$ 4,923,000
5	Type 4 STEG Connection	226	EA	$ 9,845	$ 11,055	$ 2,225,000	$ 2,499,000
6	Type 1 STEP Connection	19	EA	$ 8,360	$ 9,570	$ 157,000	$ 179,000
7	Type 2 STEP Connection	168	EA	$ 8,360	$ 9,570	$ 1,406,000	$ 1,609,000
8	Type 3 STEP Connection	50	EA	$ 9,955	$ 11,165	$ 496,000	$ 557,000
9	Type 4 STEP Connection	12	EA	$ 12,265	$ 13,475	$ 153,000	$ 168,000
10	Pressure Sewer/Force Mains	26,100	LF	$60			$1,566,000
11	4" Gravity Sewer	220,100	LF	$129			$28,422,000
12	Road Restoration	1	EA	$2,000,000			$2,000,000
13	Pocket Pump Station	2	EA	$200,000			$400,000
14	Duplex Pump Station	2	EA	$433,333			$867,000
15	Triplex Pump Station	1	EA	$600,000			$600,000
16	Odor Control	5	EA	$50,000			$250,000
17	Standby Power Facilities	3	EA	$360,000			$1,080,000
					Subtotal	***$ 60,441,000***	***$ 61,016,000***
	Treatment System						
1	EQ / Recirculation / Dosing Tanks						$4,320,000
2	Biofilters						$8,880,000
3	Nitrex™						$4,560,000
4	Disinfection / Filtration / Controls						$2,760,000
5	Contractor Overhead and Profit			15%			$3,078,000
6	Treatment Processes Contingency			30%			$6,156,000
7	Sales Tax			8%			$1,641,600
8	Land Acquisition	7.0	acres	$500,000			$3,500,000
9	Standby Power Facilities	2	EA	$360,000			$720,000
10	Odor Control	2	EA	$50,000			$100,000
					Subtotal		***$35,716,000***
	Dispersal / Reuse System - Non Residential						
1	Distribution Force Main	23,000	ft	$60			$ 1,380,000
2	Drainfield/Drip Irrigation	1,204,400	ft^2	$2			$ 2,408,800
3	Contractor Overhead and Profit			15%			$ 361,320
4	Contingency			30%			$ 722,640
5	Sales Tax			8%			$ 192,704
6	Land Acquisition	27.7	acres	$500,000			$ 13,850,000
					Subtotal		***$18,916,000***
	Scenario 2 Total Construction Costs - No Residential Reuse					**$115,073,000**	**$115,648,000**

The Mid-town site is purchased and this covers land costs for the eastern site

This covers costs for recycled water lines to Giacomazzi and for added storage.

Reducing the 30% contingencies to 10% and factoring the 18% escalation (see Page 12 of Task 3 attached), costs are reduced another $5 million.

This is reduced by about $12 million since the LOSG plan eliminates drain fields, leaving enough to purchase Giacomazzi ($1.5 million)

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Table 4-5: Fine Screening Report Construction Cost Estimates

Project Element		Seawater Intrusion						Tri-W	LAI STEG Scenarios			
		Mitigation Level 1		Mitigation Level 2		Mitigation Level 3		Project	Scenario 1		Scenario 2	
		90 AFY ($1M)	140 AFY ($1M)	190 AFY ($1M)	240 AFY ($1M)	550 AFY ($1M)	600 AFY ($1M)	~285 AFY ($1M)	Non-Residential Reuse ($1M)	Residential Reuse ($1M)	Non-Residential Reuse ($1M)	Residential Reuse ($1M)
Collection System	STEP	$65 - 81	$65 - 81	$65 - 81	$65 - 81	$65 - 81	$65 - 81	$N/A	$60.4	$60.4	$61.0	$61.0
	Gravity	$83 - 90	$83 - 90	$83 - 90	$83 - 90	$83 - 90	$83 - 90	$81 - 82				
Treatment (Liquids & Solids)	STEP	$14 - 18	$23 - 25	$20 - 22	$23 - 25	$23 - 25	$23 - 25	N/A	$38.8	$38.8	$35.7	$35.7
	Gravity	$15 - 22	$23 - 26	$20 - 22	$23 - 26	$23 - 26	$23 - 26	$55				
Disposal / Reuse		$13 - 16	$13 - 14	$15 - 17	$13 - 14	$26 - 30	$26 - 27	$20 - 23	$18.9	$47.8	$18.9	$47.8
Treatment Facility Site		$1 - 3	$1 - 3	$1 - 3	$1 - 3	$1 - 3	$1 - 3	$1 - 3	Included in Treatment			
Permitting / Mitigation		$1 - 2	$1 - 2	$1 - 2	$1 - 2	$1 - 2	$1 - 2	$1 - 2	$2.00	$2.00	$2.00	$2.00
Total Construction Costs	STEP	$94 - 120	$103 - 126	$102 - 125	$103 - 126	$116 - 142	$116 - 139	N/A	$120.0	$148.95	$117.65	$146.56
	Gravity	$113 - 132	$121 - 135	$120 - 134	$122 - 135	$135 - 151	$134 - 148	$158 - 165				
Total Construction Costs Escalated to Mid-Point of Construction	STEP	$117 - 150	$128 - 157	$126 - 156	$129 - 157	$144 - 176	$144 - 173	N/A	$149.4	$185.44	$146.47	$182.46
	Gravity	$141 - 164	$151 - 168	$149 - 167	$152 - 168	$168 - 188	$167 - 184	$197 - 205				
Project Costs	STEP	$18 - 24	$18 - 24	$18 - 24	$18 - 24	$21 - 26	$21 - 26	N/A	$24.0	$29.79	$23.53	$29.31
	Gravity	$16 - 21	$16 - 21	$16 - 21	$16 - 21	$19 - 23	$19 - 23	$12 - 17				
Total Project Costs (Capital Costs)	STEP	$135 - 174	$146 - 181	$144 - 180	$147 - 181	$166 - 202	$165 - 199	N/A	$173.4	$215.23	$170.00	$211.78
	Gravity	$157 - 185	$167 - 189	$165 - 188	$168 - 189	$187 - 211	$186 - 207	$209 - 222				

Adjusted Cost

← Minus $15 to $17.3 m =
~ $ 153 to $ 155 m
(Removes exaggerated pipe costs and the assumption tanks cannot be shared - see Page 19 of this TM attached.)

Minus ~ $17 m =
~ $ 136 to $ 138 m
(Subtracts $12 million in drainfield land costs and $5 million in contingency costs by using the 10% contingency for the proposed system and deducting the 18% escalation factor.)

Add $5-7 million for the water use efficiency and management components of the LOSG plan
Total cost = ~ $ 145 m

~ $35 million less than current project

- higher level of mitigation
- much less energy use/GHG production
- could reverse seawater intrusion

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Table 5-4: Scenario 2 Collection and Dispersal System O&M Costs – No Residential Reuse

#	Description			Total
1	**Labor**	**Collection**	**Dispersal**	**$ 249,600**
	FTE	2	1	
	Total Hours	4,160	2,080	
	hourly rate	$40.00	$40.00	
2	**Sludge Disposal**			**$ 143,100**
	Frequency of pumping (years)	5	n/a	
	Total # Pumped per year	4,769	n/a	
	Cost / Pumpout	$150.00	n/a	
3	**Electricity**	**Collection**	**Dispersal**	**$ 70,400**
	Design Flow (gpd)	1,200,000	1,200,000	
	% Pumped	70%	100%	
	Power Unit Cost ($/kWh)	$ 0.12	$ 0.12	
	Total Pumping Cost	*$28,961*	*$41,354*	
4	**Equipment Maintenance/Replacement**			**$ 160,600**
	STEP Pump Maintenance / Replace			*$ 14,229*
	Frequency of Replacement (yr.)	7		
	# / year	36		
	Cost / Replacement	$400		
	Pump Station Maintenance / Replace			*$ 96,280*
	% of Construction Cost	2.0%		
	Odor Control Maintenance / Replace			*$ 50,000*
	% of Construction Cost	20.0%		
		Total O & M Cost		**$ 623,700**

← Very low energy costs compared to proposed project (about $\frac{1}{5}$th) (see Attachment 10, p. 3)

Table 5-6 presents the a comparison of the Fine Screening Report O&M cost estimates from the August 2007 Fine Screening Analysis Report to the O&M cost estimates developed for the LAI decentralized scenarios. As with the capital cost comparison, the costs presented include all contingencies and allowances and therefore are comparable to the high end of the ranges presented in the Fine Screening Analysis Report. In addition, only one treatment and collection system were analyzed, eliminating the need for a "Low" end of the costs. The LAI Scenarios O&M costs represent the "High" end of O&M cost estimates. *

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Table 5-5: Summary of Treatment Facilities O&M Costs

Treatment Site	Design Flow (gpd)	Contract Operations	Sludge Disposal	Electricity	Equipment Maintenance / Replacement	Odor Control Maintenance / Replacement	Sampling - Lab Costs	Admin.	Permit Compliance Fees	Annual Misc. O&M Costs	Total
N-1	205,000	$29,120	$2,010	$20,200	$65,200	$10,000	$33,000	$12,000	$12,000	$19,000	$202,600
N-2	198,000	$29,120	$1,950	$19,900	$63,300	$10,000	$33,000	$12,000	$12,000	$19,000	$200,300
N-3	176,000	$29,120	$1,730	$18,400	$56,300	$10,000	$33,000	$12,000	$12,000	$18,000	$190,600
E-1	77,000	$29,120	$760	$12,200	$24,500	$10,000	$33,000	$12,000	$12,000	$14,000	$147,600
SE-1	95,000	$29,120	$930	$13,300	$30,100	$10,000	$33,000	$12,000	$12,000	$15,000	$155,500
W-1	164,000	$29,120	$1,610	$17,700	$52,300	$10,000	$33,000	$12,000	$12,000	$17,000	$184,800
W-2	193,000	$29,120	$1,890	$19,500	$61,500	$10,000	$33,000	$12,000	$12,000	$18,000	$197,100
Scenario 1 Total	**1,108,000**	**$203,840**	**$10,880**	**$121,200**	**$353,200**	**$70,000**	**$231,000**	**$84,000**	**$84,000**	**$120,000**	**$1,278,500**
Northeast	440,000	$29,120	$3,950	$32,700	$128,500	$10,000	$33,000	$12,000	$12,000	$27,000	$288,300
Midtown	770,000	$29,120	$6,900	$51,600	$224,500	$10,000	$33,000	$12,000	$12,000	$38,000	$417,200
Scenario 2 Total	**1,210,000**	**$58,240**	**$10,850**	**$84,300**	**$353,000**	**$20,000**	**$66,000**	**$24,000**	**$24,000**	**$65,000**	**$705,500**

Table 5-6: Comparison of O&M Cost Estimates

Project Element		Seawater Intrusion						Tri-W	LAI STEG Scenarios			
		Mitigation Level 1		Mitigation Level 2		Mitigation Level 3		Project	Scenario 1		Scenario 2	
		90 AFY ($1M)	140 AFY ($1M)	190 AFY ($1M)	240 AFY ($1M)	550 AFY ($1M)	600 AFY ($1M)	~285 AFY ($1M)	Non-Residential Reuse ($1M)	Residential Reuse ($1M)	Non-Residential Reuse ($1M)	Residential Reuse ($1M)
Collection System	STEP	0.8	0.8	0.8	0.8	0.8	0.8	N/A	$0.6	$0.8	$0.6	$0.8
	Gravity	0.5	0.5	0.5	0.5	0.5	0.5	0.7				
Treatment	STEP	$0.5 - 0.6	$0.9 - 1.8	$0.8 - 1.7	$0.9 - 1.8	$0.9 - 1.8	$0.9 - 1.8	N/A	$1.3	$1.3	$0.7	$0.7
	Gravity	$0.5 - 0.7	$0.8 - 1.8	$0.7 - 1.7	$0.8 - 1.8	$0.8 - 1.8	$0.8 - 1.8	$1				
Solids (Sub Class B)	STEP	$0.03 - 0.3	$0.03 - 0.3	$0.03 - 0.3	$0.03 - 0.3	$0.03 - 0.3	$0.03 - 0.3	N/A	Included in Collection and Treatment O&M Costs			
	Gravity	$0.04 - 0.5	$0.04 - 0.5	$0.04 - 0.5	$0.04 - 0.5	$0.04 - 0.5	$0.04 - 0.5	0.5				
Disposal / Reuse	STEP	$0.1 - 0.3	$0.1 - 0.2	0.4	0.4	$0.1 - 1.1	0.3	N/A	Included in Collection System O&M Costs			
	Gravity	$0.1 - 0.3	$0.1 - 0.2	0.4	0.4	$0.1 - 1.1	0.3	$0.4 - 0.5				
Total O&M Costs	STEP	$1.4 - 1.9	$1.8 - 3.0	$2.0 - 3.1	$2.1 - 3.2	$1.8 - 3.9	$2.0 - 3.1	N/A	$1.9	$2.04	$1.33	$1.50
	Gravity	$1.1 - 1.9	$1.4 - 2.9	$1.6 - 3.0	$1.7 - 3.2	$1.4 - 3.8	$1.6 - 3.0	$2.3 - 2.4				

$1 million less per year than the proposed project and may be less combined w/ the LOSG plan.

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6. Cost Analysis Summary

Table 6-1 summarizes the costs for Scenarios 1 and 2 and compares them to the Fine Screening Report Estimates, using a total of 5,353 Benefit Units (BU) from the Assessment Engineers Report.

Table 6-1: Summary of Capital and Annual O&M Costs

Scenario			Project Cost ($1M)		Project Cost Per BU[3]		Annual O&M Cost ($1M)		Annual O&M / BU		Annual Power Use[1] (kWhr)	Average Annual Power Use[1] (kW)
			Level 2	Level 3	Level 2	Level 3	Level 2	Level 3	Level 2 (Low)	Level 3 (High)		
Scenario 1	7 Zones		$173	$215	$32,402	$40,207	$1.88	$2.04	$351	$382	1,600,000	183
Scenario 2	2 Zones		$170	$212	$31,758	$39,562	$1.33	$1.50	$248	$279	1,160,000	132
Fine Screening Report - Level 2 Mitigation	190 AFY	STEP	$144 - 180		$30,263		$2.0 - 3.1		$374	$579		
	190 AFY	Gravity	$165 - 188		$32,972		$1.6 - 3.0		$299	$560		
	240 AFY	STEP	$147 - 181		$30,637		$2.1 - 3.2		$392	$598		
	240 AFY	Gravity	$168 - 189		$33,346		$1.7 - 3.2		$318	$598		
Fine Screening Report - Level 3 Mitigation	550 AFY	STEP		$166 - 202		$34,373	$1.8 - 3.9		$336	$729		
	550 AFY	Gravity		$187 - 211		$37,175	$1.4 - 3.8		$262	$710		
	600 AFY	STEP		$165 - 199		$34,000	$2.0 - 3.1		$374	$579		
	600 AFY	Gravity		$186 - 207		$36,708	$1.6 - 3.0		$299	$560		

[1]Power use will be comparable for Residential Reuse and conventional reuse/dispopsal, as minor differences in dispersal power use are negligible compared to total collection/treatment/dispersal power use.

7. Caveats and LAI Opinions on Cost Estimates

In an effort to maintain as much consistency as possible between cost estimates developed in the Fine Screening Analysis Report, a number of assumptions were used for which LAI has a varying opinion. The preceding tables present cost data that is consistent with the Fine Screening Analysis. This section discusses items for which LAI has a varying opinion and the implications on the estimated costs.

7.1. Gravity Collection Pipe Costs

LAI has a varying opinion on the assertion that costs are similar between the STEG collection system and the conventional gravity collection system, and that $129/LF is the best available information for these costs. *

LAI is of the opinion that there is a significant difference between the installed cost of 4" vs. 8" gravity pipe. Material costs as well as installation costs are higher for 8" pipe and fittings. In addition, with Scenario 1, there will be no pipe greater than 8" with the vast majority being 4". LAI does not have local comparable bid tab values for the smaller pipe diameter and does not wish to render an opinion on the local installation costs. It is simply noted in this section that LAI believes a savings of $8+ million is reasonable with the STEG collection system due to pipes that will be half the size of conventional gravity pipe across most of the system. This savings is based on an assumed unit price of $90/LF. These savings are not reflected in the *

Biased assumption raises cost of STEP/STEG compared to conventional gravity (the proposed system).

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preceding analysis that uses the $129/LF for STEG gravity collection pipe that was taken from bid tab values for 8" gravity sewer.

This caveat is summarized below:

Fine Screening Analysis Unit Cost - $129 / LF

LAI's Opinion of Appropriate Unit Cost - $90 / LF

Total Potential Savings - $8 million *

7.2. Gravity Collection Pipe Type Issues

STEG systems have costs/savings associated with septic tanks and smaller, shallower pipes. The septic tanks have a construction cost of around $10 million. Normally, these costs are offset by the savings associated with the smaller diameter, shallower pipe and potential treatment system cost savings. However, the methodology used in this analysis carries the costs of the septic tanks without crediting the savings of the smaller, shallower pipe. *

In consideration of this attribute of the cost estimating procedure, the alternative of a conventional gravity collection system with a large septic tank at the treatment sites may be desired/preferred. Construction costs for the "centralized" septic tanks would be approximately $2 - $3 million. This would result in a savings of approximately $7 - $8 million using this cost estimating methodology.

Addresses GHG issue.

In addition, this approach would mitigate the alleged concern that septic tanks are major contributors to greenhouse gases (in particular methane) and would allow recovery of the methane from the centralized locations for beneficial use.

This would also address on-lot impact concerns.

7.3. Treatment Facility Costs

The costs for the LAI scenarios presented in this report are for wastewater facilities that produce a Title 22 compliant effluent. The range of costs presented in the Fine Screening Analysis appears to encompass a variety of treatment facilities most of which will not produce Title 22 compliant effluent as analyzed. In comparing the options, this should be factored in so that the appropriate values are used for comparison.

Tertiary treatment is $3.5 million per SWRCB Financial Assistance Credit Review p. 2.

7.4. Reuse (Purple) Piping Costs

The Residential Reuse option carries the $47.8 million construction costs associated with purple pipe back to each individual residence in lieu of the drainfield option of $18.9 million construction costs. Capital costs are approximately 149.4% of construction costs. This option is unique to the LAI Residential Reuse scenarios.

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7.5. Shared Septic Tanks

It is understood that a policy decision has been made that septic tanks are not to be shared and that this decision may be revisited as the project team explores cost saving measures. Given the density of development, there exists the potential to save approximately $4+/- million by sharing septic tanks. In addition, given the complicating issue of shared electrical service, LAI submits that STEG systems are the only systems that can feasibly utilize shared septic tanks. The majority of connections in LAI's scenarios are STEG systems. *

This biased assumption adds costs and on-lot impacts unnecessarily.

Potential Savings with Shared Septic Systems - $4 million

7.6. O&M Costs

Allowances were made in this report for the following costs that do not appear to be included in the Fine Screening Analysis:

- Administrative costs required for maintaining operations staff and equipment
- Daily sampling of effluent required by Title 22 as well as periodic sampling required by the permit
- Miscellaneous/Contingency for unanticipated operational expenses

There is a generic "Allowance" added to the Labor, Power, Maintenance/Replacement costs in the amount of $50,000 for most gravity collection system treatment facilities and $20,000 for STEP collection system treatment facilities. LAI believes that this is insufficient to cover the above listed costs. LAI has a total of $76,000 for these costs included in the O&M cost estimates presented in this report. This represents a difference of $26,000 - $56,000 on the annual O&M costs between the Fine Screening Analysis and this report.

7.7. Aesthetics

The Nitrex™ system will be largely below grade with the Nitrex™ filters taking the form of a constructed wetland. This feature can be landscaped into an area that has aesthetic value for minimal added expense. If this is desired, LAI estimates the additional landscaping costs to be approximately $2 million.

This adds to community acceptance and feasibility.

7.8. Total Potential Savings

The implications of our opinions on shared septic tanks and unit pricing on installed 4" vs. 8" pipe and fittings represents a total potential savings of $12 million dollars on the collection system costs. When project costs and escalation are added, this represents a total savings of $15 - $17.3 million that can be deducted from the bottom line in Table 4.5. *

It is LAI's opinion that the $7 - $8 million "savings" from replacing the septic tanks with centralized tanks is not representative of actual project costs. However, given that costs representative of a conventional gravity system are being carried forward, the $2 - $3 million

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cost of adding centralized septic tanks is appropriate and may wish to be considered if there is a strong sentiment against individual septic tanks and/or if the greenhouse gas issue is of significance.

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Task 2: Decentralized Wastewater Treatment Scenarios

These factors add to the value of a decentralized system but were not considered in later reviews (e.g., EIR) *

9. Environmental Issues and Caveats

Caveats:

1. It is noted that existing flows are approximately 77% of the buildout flows. The potential savings associated with a water conservation program could be further quantified by examining water use records and plumbing fixtures in representative properties. *

The LOSG sustainable basin plan maximizes conservation.

Environmental Issues:

1. Energy Use

Estimates of the energy use associated with the decentralized options will be provided, in the Task 3 Report.

2. Energy Generation / Sustainability

Zero net energy use is possible from this project w/ the LOSG plan

Energy generation to at least offset consumptive use of the wastewater system could be a project component. Treatment and disposal sites could have solar panels. Wind power may be a cost-competitive option. We will provide opinions on these matters in the Task 3 Report. *

3. Carbon Footprint

It will have the smallest carbon footprint among alternatives.

Due to the passive nature of the proposed decentralized system, its carbon footprint is expected to be the lowest amongst options. Energy use of the different components will be provided in the Task 3 Report. *

As methane will be produced in the proposed septic tanks, it is suggested that the collection system incorporate ventilation design to concentrate these gases for destruction, or if economically viable, productive use.

4. Wetlands

The Nitrex™ component can be a subsurface flow wetland with or without open water to support varying types of aquatic vegetation. *

5. Landscape Design

The landscape of the treatment units can be visually appealing at modest cost, and can serve a multitude of uses such as walking/bike paths, gardens, etc. to engender public acceptance and in the interest of being a "good neighbor", it is proposed that creative landscaping with community input would be a major feature of the decentralized approach, such as illustrated on Figure 8-1. *

DEIR

system. The collection system is a combination of pipelines that flow by gravity and pipelines pressurized by the accumulated pressure from the individual STEP tank pumps. At least every five years, septage haulers will pump out the accumulated septage in each septic tank and haul the septage to the wastewater treatment plant.

Low Pressure Collection System

Low Pressure Collection Systems (LPCS) utilize individual grinder pumps at each connection that grind up solids and convey the resulting slurry to the collection system and then to a treatment site or pump station. LPCS are similar in design and operation to STEP systems, except that no individual septic tanks are used and both solids and liquids are conveyed through the collection system to the wastewater treatment plant.

Vacuum Sewer

Vacuum sewer systems rely on vacuum stations to create a collection system that operates under a vacuum. A small retention facility is located at each service connection. When the retention facility is full, a vacuum/interface valve opens and allows the solids and liquids to be conveyed to the main vacuum station. Since vacuum sewer systems are closed systems, the collection system pipelines can be located close to the ground surface, follow the natural grade and have smaller diameters than conventional gravity collection systems.

Comparison of Collection System Alternatives

The results of comparing the collection system component alternatives against the project screening criteria are summarized in Table 7-5. The Low Pressure Collection System (LPCS) with grinder pumps and the Vacuum System were classified as Level C alternatives and dropped from further consideration. Both the LPCS and vacuum collection system have higher energy requirements and maintenance costs than the gravity and STEP/STEG collection systems as indicated in Table 7-5.

Vacuum is not analyzed in DEIR Alternatives section (Append. P)

Gravity and STEP/STEG collection systems are both feasible collection systems and were designated Level A alternatives. As described in Table 7-5, each alternative has advantages and disadvantages compared to the other. For instance, gravity collection systems require more energy to operate, but they emit less greenhouse gasses because STEP/STEG systems emit a large amount of greenhouse gasses and odors from septic tanks, chemicals and septage hauling. (Carollo Engineers 2008i) Similarly, excavating streets to install gravity sewers is more disruptive to street traffic, but installing STEP/STEG tanks disrupts private properties and requires a permanent public easement on each property. The capital construction cost savings for STEP/STEG collection systems are offset by the higher operations and maintenance costs for maintaining the 4769 pump stations and periodically pumping and hauling the accumulated septage. More detailed comparisons of the potential collections systems are provided in Appendix P, Alternatives Information, and in the Fine Screening Report (Carollo Engineers 2007a).

Exaggerated, inaccurate description of STEP

A conclusion based on biased assumptions (see Attachments #8, 9, 11)

DEIR

Not accurate/ supported

Table 7-5: Screening of Collection System Alternatives

Baseline Criteria	Gravity[1]	Combined Septic-Tank Effluent Pumping (STEP)/ Septic Tank Effluent Gravity (STEG) System	Low Pressure Collection System (LPCS)[1]	Vacuum System
Level Designation	**Level A**	**Level A**	**Level C**	**Level C**
Groundwater Quality & RWQCB Waste Discharge Requirements	• Meets RWQCB requirements for elimination of pollution to groundwater • Least ex-filtration • Septic tank effluent that currently recharges aquifer is removed	• Meets RWQCB requirements for elimination of pollution to groundwater • Some exfiltration with pressurized pipelines. • Septic tank effluent that currently recharges aquifer is removed	• Meets RWQCB requirements for elimination of pollution to groundwater • Less exfiltration than STEP; more than gravity system. • Septic tank effluent that currently recharges aquifer is removed	• Meets RWQCB requirements for elimination of pollution to groundwater
Water Resources	• Inflow - As gravity system ages, Inflow can occur at lateral connections, manholes, and mainline joints. Regular maintenance can reduce • Infiltration - Potential where mainlines and manholes are below water table. • Septic tank effluent that currently recharges aquifer is removed.	• Inflow - As STEP/STEG system ages, Inflow can occur at house lateral connections and STEP/STEG tank joints. • Infiltration - Unlikely. • Septic tank effluent that currently recharges aquifer is removed	• Inflow - As LPCS system ages, Inflow can occur at house lateral connections and grinder pump station connections. • Infiltration - Unlikely. • Septic tank effluent that currently recharges aquifer is removed	Not evaluated. Eliminated w/o analysis (see Appendix P)
Energy/Air Quality	• 500,000 kwhr/year • Odors - Minimal to Moderate Potential • Lower GHG emissions due to absence of septic tank venting and less chemical production.	• 425,000 kwhr/year • Odors - Moderate to severe potential • Higher GHG emissions due to septic tank venting, chemical production and septage hauling. • Sludge reduction in treatment plant is partially offset by septage addition. • Requires carbon addition for nitrogen removal. • Tanks replaced or moved to front yard	• 425,000 kwhr/year • Grinder pumps less efficient that STEP pumps. • Odors - Moderate potential	• Highest energy demand ?

A mix of cluster and on-site systems is not considered.

DEIR

Table 7-5 (Cont.): Screening of Collection System Alternatives

Biased assumptions that increase costs/impacts leading to the finding that gravity is environmentally preferable

Baseline Criteria	Gravity[1]	Combined Septic Tank Effluent Pumping (STEP)/ Septic Tank Effluent Gravity (STEG) System	Low Pressure Collection System (LPCS)[1]	Vacuum System
Level Designation	**Level A**	**Level A**	**Level C**	**Level C**
Costs	• 7 pump stations and 12 pocket pumps to maintain. • Deeper Sewers require greater disruption during construction. • Higher construction cost but lower O & M cost due to lower staffing and maintenance requirements.	• 4,769 pumps and STEP tanks to maintain. • Septage haulers pump STEP tanks at least every 5 years. • Shallower Depth for pipeline so trenchless technology can be used for portions of collection system. • Greater private yard disruption during STEP/STEG tank installation. • Lower construction cost but higher maintenance and septage hauling costs. • Permanent public easement required for STEP/STEG tank maintenance.	• 4,769 grinder pumps to maintain. • Shallower Depth for pipeline so trenchless technology can be used for portions of collection system. • Greater private yard disruption during grinder pump installation. • Can be used with gravity system in areas with shallow groundwater • Permanent public easement required for grinder pump maintenance.	• Highest maintenance cost. • Vacuum system pumps and 4,769 vacuum interface valves to maintain. • Shallower Depth ? Vacuum is not analyzed
Permitability	• Noise - Comparable to STEP/STEG during construction. Quieter during operations. • Cultural Resources - Lower potential impacts. • Aesthetics: Less impact since most community facilities are underground. Traffic - Construction of a gravity system would lead to temporary impacts, but would be located further away from homes, etc.	• Noise - Comparable to gravity during construction. Higher operations noise from false and real STEP/STEG tank alarms and septage pumping. • Cultural Resources - Higher potential impacts from STEP/STEG tank excavation in private yards. • Aesthetics: More impact during operations due to 2 24-inch grade lids, alarms and lights.	• Noise - Comparable to STEP/STEG during construction. Higher operations noise from false and real grinder pump alarms. Grinder pumps noisier than STEP pumps. • Cultural Resources: - Higher potential impacts from grinder pump excavation in private yards. • Aesthetics: More impact during operations due to access hatch, alarms and lights.	Not evaluated

assessment of how well regional treatment meets the project criteria, is provided in Appendix P-5 (Kennedy/Jenks Consultants 2008) and in the Regional Treatment Technical Memorandum (Carollo Engineers 2008j).

Decentralized Treatment

Decentralized treatment would involve collecting wastewater and treating the combined flow at between 2 and 30 neighborhood-level "cluster" treatment plants. Effluent disposal would occur through neighborhood leachfields and/or agricultural/urban reuse. Tertiary treatment would be required if the effluent is recycled for urban and/or agricultural purposes. It is unknown how difficult it would be to acquire vacant lots for the decentralized treatment facilities or to secure the necessary permits for each treatment facility and site. Individual WDRs and monitoring would be required for each treatment and disposal system. Since there are no existing decentralized treatment systems in California in a community similar in size to Los Osos, regulatory approval by the RWQCB for the proposed recirculating media filters (RMF) and Nitrex™ system is a critical concern that would need to be resolved.

The Mid-town site is purchased

only 2 sites

Recommended by EPA

Because the wastewater will not be pumped to a distant treatment plant, the raw wastewater conveyance system capital construction costs and energy requirements would be reduced. However, these savings would be offset by higher costs to construct the treatment facilities and effluent distribution systems, especially for the residential reuse scenarios. The additional staff time required for maintaining the decentralized system would also increase life cycle costs over a centralized system. For all these reasons, decentralized cluster-based treatment has been designated a Level C alternative and will dropped from further consideration. Additional detailed evaluation of this alternative is provided in Appendix P-6 (Kennedy/Jenks Consultants 2008) and in the Decentralized Treatment Technical Memorandum (Carollo Engineers 2008a).

Construction: $35M less

Not accurate

O&M $1m less per year with 1/5th energy cost (see Attachments 8, 9, 10, p. 3)

Centralized Treatment

Centralized treatment consists of collecting and transporting all the raw wastewater to a single treatment facility. This approach will consolidate many of the construction and operations phase impacts to a single site that can be somewhat distant from the Los Osos developed area. Effective, proven, and reliable treatment technologies such as facultative ponds, oxidation ditches and membrane bioreactors can be cost effective at this scale and provide easier monitoring and control of the effluent quality. There is also an economy of scale to construct and operate centralized treatment facilities, including reduced staffing. In addition, staff can more easily maintain safeguards to reduce the risk of treatment system failures. Partially offsetting the savings for the single treatment facility are the added capital and operating costs and energy requirements to transport the raw wastewater to the treatment facility.

Project design and permitting can be streamlined because there will be a single WDR permit from the RWQCB rather than separate WDR permits for each treatment facility that is part of a decentralized treatment system. From an environmental standpoint, the project impacts are consolidated on a single

DEIR, Appendix P (Tech Memo 2.2)

STEP/STEG or gravity collection system would be used, with the collection/conveyance system following the Los Osos Valley Road to Eto Lane alignment.

5.3 Priority C – Other Alternatives

Four alternative approaches to LOWWP implementation were defined and evaluated as part of the EIR planning process. The evaluations of the following four alternatives have been summarized in separate Tech Memos, as listed for each alternative.

The EIR does not analyze a project with a mix of cluster and on-site systems.

- No Project
- Onsite Treatment (Tech Memo 2.3)
- Regional Treatment (Tech Memo 2.5)
- Decentralized Treatment (Tech Memo 2.6)

The results of the evaluations indicated that three of these alternative approaches did not meet the project objectives, and the alternatives were dropped from further consideration. The fourth alternative is to be retained as part of the list of potentially viable alternatives. Following are summary notes regarding the status of each alternative:

this results from poor basin management, not septic systems.

No Project: The "no-action" alternative would maintain existing conditions, which involve septic systems and onsite leach fields. The negative effects from existing conditions on groundwater resources has been well documented, including continued salt-water intrusion, continued nitrogen loading in the upper aquifer, and a continuing decline in potable water quality. With the possibility of RWQCB enforcement action against the community if existing conditions are maintained, the "No Project" alternative was dropped from consideration as a non-viable option.

optimizing the current system w/ integrated management plans is not considered.

Onsite Treatment: Onsite treatment would involve constructing treatment facilities at each property location with habitable improvements. Several options for onsite treatment systems have been identified, including proprietary systems that have not been recognized by the RWQCB. Implementing onsite treatment would lead to extensive disruption throughout the project area, especially in sensitive habitat areas. In addition, the high life cycle costs for construction and maintenance of onsite systems resulted in onsite treatment being dropped from consideration as a non-viable option.

Regional Treatment: Regional treatment would involve collecting wastewater from the communities in the Morro Bay and/or the California Men's Colony (CMC) vicinity and treating the combined flow at one of three optional sites for a regional treatment plant. This alternative would involve constructing treatment capacity at the Morro Bay treatment plant, the CMC treatment plant, or constructing a new treatment facility in the Chorro Valley. In addition, large diameter pipes would be constructed to convey raw wastewater to the regional facility. Construction of the treatment facility and associated conveyance piping would lead to extensive disruption throughout the project area, especially in sensitive habitat areas. In addition, community acceptance for this alternative is low, and regional treatment has been dropped from consideration as a non-viable option.

See Attachments 5, 8, 9.

Decentralized Treatment: Decentralized treatment would involve collecting wastewater and treating the combined flow at between 2 and 30 neighborhood-level "cluster" treatment plants. Effluent disposal would occur through leach fields and/or agricultural/urban reuse. Construction of the treatment facilities and associated conveyance piping would lead to extensive disruption throughout the project area, especially in sensitive habitat areas. In addition, the additional staff time required for maintaining the decentralized system would increase life cycle costs over

The Los Osos plan eliminates leach fields. The plan with 2 treatment sites uses the Mid-town site (purchased + disturbed) and the staging site for the prior project (already disturbed)

EIR TM 2.2, Appendix P, DEIR 3

centralized systems. Decentralized treatment, due to capital cost, operating cost, and operability requirements, will be dropped from further consideration.

The EIR brings forward biased assumptions from the LOWWP Fine Screening report and Tech Memos that exaggerate the costs of STEP/STEG and decentralized alternatives, e.g., exaggerated pipe costs and assumption that every property must have a tank (no shared tanks) (see Attachments #8, 9, 11). The decentralized (Lombardo) alternative would also be 95% STEG (gravity), greatly reducing energy use and maintenance.

EIR Technical Memorandum 2.3
On-site Treatment
Appendix P, DEIR

2.4 Complex and expensive monitoring requirements

Every discharger is required under public law 92-500 to have an approved permit issued by the regulating agency, in Los Osos, the Central Coast Regional Water Quality Control Board (CCRWCQB). The CCRWQCB is required to issue requirements in accordance with various Federal and State laws and in compliance with the Basin Plan, prepared and updated in accordance with Section 208 of PL 92-500. The Basin plan sets such governing requirements and receiving water requirements and discharge requirements based on the administratively determined beneficial uses of the local water.

USDA policy requires centralized management

In order to verify that these Basin Plan requirements, and through the permit, specific monitoring requirements are set by CCRWQCB action that will mandate frequency, sampling technique, and specific test requirements to observe and report the effluent water quality. The fact that a large number of onsite systems could serve in lieu of a central wastewater treatment system does not allow for an averaging effect of the potentially large number of systems. Each system would be required to monitor individually and incur the management, administrative, and laboratory costs for each onsite system. Each discharger could be expected to pay these recurring costs.

Not per 885 waiver (see Attachment #12)

The regulatory and monitoring requirements are unclear. Assembly Bill (AB) 885 that was signed by the Governor in September 2000 requires the establishment of minimum statewide standards for on-site systems, and it is anticipated that extensive monitoring of these systems will be required. In addition it is unclear how or if the Central Coast Water Quality Control Board will permit these advanced individual on-site systems. The regulatory requirements for these systems are unclear at this time and will add to the costs of these systems and will delay project implementation (Carollo 2008a).

2.5 Complex and expensive maintenance and management requirements

These systems are quite complex with multiple pumps and process controllers required to operate both the anaerobic and aerobic processes. This complexity applied to 4,679 individual units would impose a major, long-term operation and maintenance (O&M) burden on the management entity set up for this project. This has led at least one expert (Lombardo Associates, Inc. (LAI) and equipment vendor) to dismiss this option as not being "technically feasible" Lombardo 2007). It is to be noted that the individual on-site denitrification system developed by LAI was the only system that met the required discharge standards in LaPine.

Typically, maintenance could include periodic checks on all mechanical systems, observation of valves and openings, and observation of the local electrical and control panel. Readings should be taken on local indicators for status of operating equipment. A log should be kept of these readings to determine if any changes in performance is occurring over time.

EIR TM 2.3
Appendix P
DEIR

An alternative w/ a mix of cluster and on-site systems is not analyzed.

Section 3: Conclusions

No on-site system that requires 4,769 individual units that must be operated and maintained by a public entity is considered feasible; therefore the on-site option is eliminated from further consideration. These are the factors that make this conclusion evident:

- Lack of space on some parcels
- High cost (compared to a community system)
- Community acceptance issues
- Inability to meet effluent requirements
- Complex and expensive monitoring requirements
- Complex and expensive maintenance and management requirements

Technical Memorandum

MBA
29 October 2008
Page 2

There are a number of elements that are common to both scenarios. These commonalities include:

- A treatment process consisting of flow equalization, a recirculating media filter (RMF), a denitrification filter, a polishing filter, and final disinfection by UV and/or ozone.
- A disposal process consisting of individual residential on-lot drip irrigation facilities and/or non-residential drip irrigation and on-site subsurface disposal
- The treatment process area would be sized based on 0.23 sf/gpd, not including buffer and set back requirements
- The disposal area would be initially sized assuming a loading rate of 1 gpd/sf
- Storage of approximately 20 days would be required for periods when complete subsurface disposal could not be practiced due to climatic events.

Scenario 1

In Scenario 1, treatment is provided at 7 locations in Los Osos. The exact locations were not identified rather some representative sites were described. These included school property, vacant lots and "paper" street ("paper streets" are dedicated road rights-of-way that were never developed into streets maintained by a governmental entity. In a similar manner a number of potential disposal sites were identified, but final recommendations were not given.

Flows and treatment site requirements would be substantially reduced w/ LOSG Plan (see Attachmnt 5)

Scenario 2

In Scenario 2, treatment would occur at two sites. One site would be the Mid-Town site and would have a flow of approximately 767,000 gpd. The second site would be located in the northeast portion of Los Osos and have a flow of approximately 439,000 gpd. The potential treatment sites are better defined that those for Scenario 1, but the disposal sites are not defined in any greater detail than they were in Scenario 1.

Not needed w/ LOSG Plan

COST CONSIDERATIONS

Preliminary construction and operation and maintenance costs have been developed for these two Scenarios. These costs are presented in Table 1. It is to be noted that the capital costs include the costs of the collection system.

TABLE 1: DECENTRALIZED OPTIONS – COST SUMMARY

ITEM	SCENARIO 1		SCENARIO 2	
DISPOSAL	Residential	Non-Residential	Residential	Non-Residential
CAPITAL COST ($M)	216-240	171-1851	214-238	169-182
O&M COST ($M)	2.1	1.9	1.5	1.3

$1 million per year less (see Attachment 10, p. 3)

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Technical Memorandum

MBA
29 October 2008
Page 3 ← Three-page TM and level of analysis shows a very cursory review.

NON-COST CONSIDERATIONS

A number of items were identified in this technical memorandum as areas of concern that were not fully described. These areas of concern include:

- These decentralized facilities would be located in town in Environmentally Sensitive Habitat Areas (ESHAs) as defined by the California Coastal Commission and therefore unique siting and permitting issues must be addressed ← Scenario 2 uses disturbed land for treatment sites.
- Adjacent homeowner opposition may exist
- The availability of vacant parcels for purchase and the County's position on vacating "paper streets" is unknown ↑ Not w/ LOSG plan. (see Attachments #5 & 8)

REFERENCES

Carollo 2008 C: Carollo Engineers
Technical Memorandum
Decentralized Treatment
October 2008

LAI 2008a Lombardo Associates, Inc. 2008
Technical Memorandum, Task 1 – Design Criteria
May 2008

LAI 2008b Lombardo Associates, Inc. 2008
Technical Memorandum, Task 2 – Decentralized Wastewater Treatment Scenarios
3 July 2008

LAI 2008c Lombardo Associates, Inc. 2008
Technical Memorandum, Task 3 – Cost Estimate for Decentralized Scenarios
22 August 2008

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State Water Resources Control Board

Division of Financial Assistance

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Linda S. Adams
Acting Secretary for Environmental Protection

Edmund G. Brown Jr.
Governor

DIVISION OF FINANCIAL ASSISTANCE (DIVISION)
WATER RECYCLING FUNDING PROGRAM (WRFP)
PLAN OF STUDY (POS) APPROVAL
COUNTY OF SAN LUIS OBISPO (COUNTY)
LOS OSOS WASTEWATER PROJECT RECYCLED WATER FACILITIES PLANNING STUDY (STUDY)
WRFP STUDY NO. 3922-010

CERTIFIED MAIL NO.: 7003-3110-0003-0771-1602
Return Receipt Requested

RECEIVED
JUL 07 2011
DIVISION OF FINANCIAL ASSISTANCE

Mr. Paavo Ogren
Director of Public Works
County of San Luis Obispo
976 Osos Street, Room 207
San Luis Obispo, CA 93408

Division staff prepared this POS approval based on the County's WRFP application and supporting documents. This approval documents our understanding of the County's proposed Study, and the conditions that will apply to the financing agreement for the proposed Study. You must agree with this POS approval before we can proceed with funding the proposed Study.

This approval constitutes a final staff decision. This approval does not reserve funds for your proposed Study and it is not the financing agreement. After the Division receives the County's agreement on the eligibility decisions, schedule, and conditions in this approval, the Project Manager will request approval of a WRFP Preliminary Funding Commitment (PFC) for the proposed Study by the Deputy Director of the Division. After the Deputy Director of the Division approves the PFC, the financing agreement will be prepared and sent to the County for execution. A copy of the proposed PFC is attached to this approval. To expedite this process, please sign in the space provided below and return to your WRFP Project Manager immediately at:

Mr. David Balgobin, P.E.
State Water Resources Control Board
Division of Financial Assistance
P.O. Box 944212
Sacramento, CA 94244-2120
Phone: (916) 341-6914
E-mail: dbalgobin@waterboards.ca.gov

If you do NOT agree with this approval, then you must request a Final Division Decision within ten working days from the date in the signature block below. Your request should specify the items of disagreement and suggest the exact changes with which you will agree. Please send the request to:

Mr. James Maughan, Acting Deputy Director
State Water Resources Control Board
Division of Financial Assistance
P.O. Box 944212
Sacramento, CA 94244-2120

DIVISION STAFF APPROVAL

Sign Here: James Maughan, Acting Deputy Director
Division of Financial Assistance

6/28/11
Date

APPLICANT AGREEMENT

Using the authority delegated by the County on April 15, 2011, in Resolution No. 2011-125, I hereby agree, on behalf of the County, with the content and conditions of this POS for WRFP No. 3922-010.

Sign Here: Paavo Ogren, Director of Public Works
County of San Luis Obispo

7/6/2011
Date

GUIDELINE

WRFP Guidelines (Guidelines) adopted by the State Water Resources Control Board (State Water Board) October 21, 2004, last amended on July 15, 2008.

TYPE OF FUNDING REQUESTED

The County is requesting a Facilities Planning Study grant (50 percent matching) through the WRFP.

TOTAL STUDY COST
$102,148

TOTAL WRFP FUNDING REQUEST
$51,074

AUTHORIZED REPRESENTATIVE
Mr. Paavo Ogren
Director of Public Works
County of San Luis Obispo
976 Osos Street, Room 207
San Luis Obispo, CA 93408
(805)781-5291

PROJECT DIRECTOR
Mr. John Waddell
Project Manager
County of San Luis Obispo
976 Osos Street, Room 207
San Luis Obispo, CA 93408
(805)788-2713

AUTHORITY

2000 Bond Law
On March 7, 2000, the voters added the Costa-Machado Water Act of 2000 (2000 Bond Law, designated Proposition 13 on the ballot) to the Water Code. Water Code section 79143 provides authorization for the State Water Board to issue WRFP Planning Study grants from monies in the 2000 Bond Law Water Recycling sub-account. This authorization continues the WRFP that started under the Safe, Clean, and Reliable Water Supply Act of 1996.

State Water Board Actions
The State Water Board approved the Guidelines on October 21, 2004, last amended July 15, 2008, governing the Water Recycling Construction Program and the Facilities Planning Grant (FPG) Program. The FPG covers 50 percent of eligible costs, up to a maximum grant of $75,000 per study.

On December 4, 2007, the State Water Board, in Resolution No. 2007-0066, authorized the Executive Director, the Chief Deputy Director, the Deputy Director of the Division, or designee to make PFCs, grants, and other financial assistance agreements for facility planning studies for water recycling projects pursuant to the 2000 Bond Law. These PFCs, grants, and other financial assistance agreements shall be for studies that are routine, non-controversial, and are consistent with those policies, regulations, and agreements that the State Water Board has adopted, or will adopt, governing the internal management of those financial assistance projects managed by the Division.

TECHNICAL REVIEW

Background
On May 16, 2011, the County submitted a funding application, including a POS, to initiate and complete their Study.

Study Location
The study area is located in and around the unincorporated community of Los Osos. Los Osos is a residential community of approximately 7 square miles with a population of just over 14,800 (2007), located on the California Central Coast, approximately 10 miles west the City of San Luis Obispo and 41 miles north of the City of Santa Maria. This area receives approximately 16 inches of precipitation per year (NOAA records) with annual average temperatures ranging from 50 to 64 degrees Fahrenheit. The Study area is located entirely within the jurisdiction of the Central Coast Regional Water Quality Control Board.

Existing Facilities
The study area is currently served by individual and community septic systems. Approximately one million gallons per day of community wastewater is disposed through individual septic systems and community leachfield systems. A new wastewater treatment facility will be constructed within the study area that is planned to produce tertiary treated effluent. The County of San Luis Obispo is the wastewater agency obligated under AB 2701 (Blakeslee, 2006).

Water services to the study area are provided by Golden State Water Company, S&T Mutual Water Company and the Los Osos Community Services District.

Currently there exists within the study area, community and agricultural areas that are irrigated with potable and non-potable fresh water that may qualify for irrigation with disinfected Title 22 compliant unrestricted use recycled water.

Study Parameters
The major parameters of the Study are summarized below:

- The potential source of recycled water to be studied will be the tertiary effluent from the new Los Osos Wastewater Treatment Facility.
- The Study will examine alternative tertiary treatment needs and determine the feasibility of providing a recycled water distribution system for irrigation of urban and agricultural reuse areas.
- The recycled water alternatives that will be considered include providing recycled water for landscape and agricultural irrigation to water customers who currently use potable or untreated well water for landscape or agricultural irrigation purposes.
- The freshwater alternatives that will be evaluated will be:
  - Additional groundwater supplies
  - Imported water supplies, and
  - Water conservation

Study Description
The new wastewater treatment facility will produce unrestricted use, Title 22 disinfected recycled water. The Study will determine the feasibility of using the new wastewater treatment facility effluent water for urban and landscape irrigation purposes within the County's study area.

The County's Study will also investigate alternative water recycling pipeline alignments within the study area.

The scope of work for the County's Study includes the following major tasks:

- Conduct a recycled water market assessment.
- Develop and provide preliminary recycled water market assurances.
- Provide project alternatives analysis including an economic analysis and determination of the unit cost of recycled water for each alternative.
- Determine the unit cost of meeting recycled water demands with potable water as an economic comparison with the recommended recycled water project.
- Determine the recommended project alternative for implementation.
- Develop a construction finance plan for the recommended alternative project.
- Conduct public outreach using printed material and through direct open public forums.
- Determine the level of environmental documentation required for implementing the selected alternative. Conduct discussions with the Central Coast Regional Board and the Department of Public Health to determine potential restrictions and conditions of use of recycled water for the recommended alternative.

Eligible Costs & Disbursements

- The estimated total cost of the Planning Study is $102,148.
- The deliverables as presented in the County's POS as listed below make up the eligible tasks of this grant and are subject to the conditions in this approval. This approval does not extend to any associated studies to which the POS may refer. Any costs for the eligible tasks outlined in the POS are understood to be estimates, and are regarded as such by the Division. Therefore, POS approval does not constitute agreement by the Division on any exact figures.
- In accordance with the Guidelines, Study costs are eligible for grant disbursements only if the Division incurs them after the approval date of the PFC. In addition, grant disbursements to the County will not take place until the County and the State Water Board execute the grant agreement.
- To ensure appropriate accounting of expenses and to facilitate our review of requests for disbursements, consultants should establish a separate billing code or codes for tasks related to this grant.
- The Division will release the initial 50 percent of the grant funds upon approval of the draft Facility Planning Report (Report) and the final disbursement upon approval of the final Report.

Ineligible Costs

- Study costs incurred prior to the approval date of the PFC by the Division.
- Costs associated with preparing an application for funding from the WRFP program or for other financial assistance are not eligible for grant funding.

Study Schedule

This approval is based on submittals and Milestone dates according to the following schedule:

MILESTONE	DATE
Application Submittal	**5/16/2011 (completed)**
PFC Approval by Division	6/24/2011
Grant Agreement Term Start Date	6/24/2011
Submit Draft Report	**8/26/2011**
Midcourse Meeting	**8/31/2011**
Submit Final Facilities Planning Report, including all deliverables identified in this approval.	**12/30/2011**
Issue Final Facilities Planning Report Approval and disburse Final Grant Disbursement	9/28/12
Grant Agreement Term End Date	6/28/2013
Normal Font – Division Activity **Bold Font – County Activity**	

In accordance with the above Milestones, the final Report, including all associated documents, must be submitted by **December 30, 2011**. The Guidelines allow approval of a one-time extension of up to 12 months based on good cause.

Deliverables
At the conclusion of the Study, one hard copy and one electronic copy of the following are to be submitted to the Division:

- A final Report that fully documents all aspects of the Study.
- Preliminary recycled water market assurances for this project, such as letters of interest, letters of intent, or draft mandatory use ordinances.

ENVIRONMENTAL REVIEW

The Division has determined that this Study does not constitute a project pursuant to the California Environmental Quality Act (Pub. Resources Code, §21000 et seq.)(CEQA), and therefore a CEQA finding is not required.

REGIONAL WATER BOARD IMPACT

None

FINANCIAL AND FISCAL REVIEW

Fiscal Impact on WRFP
A total of approximately $113 Million was initially made available in the 1996 and 2000 Bond Law Water Recycling Sub-accounts for water recycling funding. Of this amount, 41 percent ($46.3 Million) was originally designated for planning grants and construction loans with 60 percent of this amount ($27.8 million) specified for Southern California.

Loan repayments from water recycling construction projects are deposited into the Water Recycling Sub-accounts and provide funds for new construction grants, loans, planning and research projects. Construction grant funds are appropriated each year during the state budget process. Funding for construction loans, planning and research grants are continuously appropriated. This planning grant will be funded from the Other Counties allocation. The available balance for construction loans and planning grants may be found in the fiscal impact table below.

Planning Grants				
	Appropriation balance*	Southern Counties (60%)**	Other Counties (40%)***	Total Appropriation
Beginning Balance: As of 6/1/2011	$22,861,871	$13,717,123	$9,144,748	$22,861,871
Proposed Commitments				
County of San Luis Obispo # 3922-010			($51,074)	($51,074)
Balances after New Commitments		**$13,717,123**	**$9,093,674**	**$22,810,797**

* Continuous appropriation balance includes funds for loans and planning study grants only. The balance reflects loans as they are posted to the account.
** Includes six counties as follows: Los Angeles, Ventura, San Diego, San Bernardino, Orange and Riverside.
***All counties not listed above are listed under "other counties"

LEGAL REVIEW

The County provided Resolution No. 2011-125, adopted on April 15, 2011, for the authorized representative from the County's Board of Supervisors.

The County does not meet the definition of an urban water supplier as defined in section 10617 of the Water Code. Therefore, the County is not required to prepare and submit an Urban Water Management Plan to the Department of Water Resources in accordance with section 10644 of the Water Code.

Water Code Section 10631.5 requires that DWR determine if an Urban Water Supplier is implementing water-demand management measures described in Section 10631 of the Water Code. As the County does not meet the definition of an urban water supplier, Water Code Section 10631.5 does not apply. The County is eligible to receive funding in accordance with Section 10631 of the Water Code.

As of January 1, 2010, Water Code section 529.5 requires an urban water supplier that applies for financial assistance from the state for a wastewater treatment project, drinking water treatment project, or water use efficiency project, or a permit for a new or expanded water supply, to demonstrate that the applicant meets the water metering requirements of Division 1, Chapter 8, Article 3.5 of the Water Code.

On May 12, 2011, the County certified that it is not an urban water supplier, as that term is understood pursuant to the provisions of section 529.5 of the Water Code.

The Study is routine and non-controversial based on documents and communications with the County: __X___ Yes _____No

SPECIAL CONDITIONS

Our approval of the County's POS is based on the following conditions:

1. The Study must be performed in accordance with the Guidelines, and with the approved POS;
2. The Study must provide a recycled water market assessment, an evaluation of recycled water and non-recycled water alternatives. In addition, a description and implementation plan for the recommended alternative, as well as the background information and analyses outlined in Appendix B of the Guidelines;
3. The Study must evaluate economic feasibility and provide a unit cost analysis in dollars per acre-foot for each alternative considered;
4. The Study must evaluate the economic feasibility of meeting recycled water demands using potable water or other non-recycled water alternative in dollars per acre foot;
5. The County is directed to enter into discussions with the Central Coast Regional Water Board staff and CDPH staff as part of the technical evaluation of the recommended alternative;
6. The County will conduct a mid-course meeting to review the progress of the Study. The meeting should include County staff, the principal consultants involved in the Study, Division staff, and any other interested or appropriate persons. The meeting should be scheduled when the market assessment is complete, draft chapters of the Study report are partially complete, and the initial recycled water alternatives have been identified. However, the meeting should occur before the proposed project alternative has been selected;
7. The County must submit a draft Report to the Division for review. Division staff will provide comments for the County's incorporation in the final Report as appropriate; and
8. The analysis performed in the final Report must comply with the policies and procedures in the Guidelines. The County must use the planning outline in Appendix B of the Guidelines for their report;
9. The Final Study shall be conducted by and bear the stamp of a California Registered Civil Engineer; and
10. The County should enter into discussions with the Golden State Water Company, the Los Osos Community Services District and S&T Mutual Water company to determine what impact the production and use of recycled water will have on each of these water agencies. The County should summarize these discussions in the Study together with a determination of whether or not it should enter into a formal agreement with any or all of these agencies in order to proceed with the recommended water recycling project.

DISTRIBUTION

John Waddell, P.E., San Luis Obispo County
David Lacaro, Central Coast Regional Water Quality Control Board
David Balgobin, DFA
Dan Newton, DFA
Peter Mizera, DFA

State Water Resources Control Board

Division of Financial Assistance

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Linda S. Adams
Acting Secretary for Environmental Protection

Edmund G. Brown Jr.
Governor

DIVISION OF FINANCIAL ASSISTANCE (DIVISION)
PRELIMINARY FUNDING COMMITMENT (PFC)
WATER RECYCLING FUNDING PROGRAM (WRFP)
COUNTY OF SAN LUIS OBISPO (COUNTY)
LOS OSOS WASTEWATER PROJECT RECYCLED WATER FACILITIES PLANNING STUDY (STUDY)
WRFP STUDY NO. 3922-010
DETERMINATION NO.: DFA-2011-20

FINDINGS

1. On March 7, 2000, the voters approved the Costa-Machado Water Act of 2000 (2000 Bond Law), and provided authorization for the State Water Resources Control Board (State Water Board) to issue WRFP facility grants;
2. The State Water Board revised guidelines governing the Facilities Planning Grant (FPG) Program by adopting the WRFP Guidelines (Guidelines) on October 21, 2004, last amended July 15, 2008;
3. On December 4, 2007, the State Water Board authorized in Resolution No. 2007-0066 the Executive Director, the Chief Deputy Director, the Deputy Director of the Division, or designee to make PFCs, grants, and other such financial assistance agreements for facilities planning studies for water recycling projects pursuant to the 2000 Bond Law. These PFCs, grants, and other such financial assistance agreements shall be for studies that are routine, non-controversial, and that are consistent with those policies, regulations, and agreements that the State Water Board has adopted or will adopt governing the internal management of those projects managed by the Division;
4. On May 16, 2011, the County submitted a grant application, requesting grant funding for its Study;
5. Division staff reviewed the application and other supporting information for the Study and determined that the Study scope meets the requirements of the Guidelines;
6. This Study is a routine, non-controversial project that is consistent with the policies, regulations and agreements the State Water Board has adopted for implementation of the WRFP;
7. The County does not meet the definition of an urban water supplier as defined in Section 10617 of the Water Code; therefore, the County is not required to prepare and submit an Urban Water Management Plan to the Department of Water Resources;
8. Water Code section 10631.5 does not apply to the County. The County is eligible to receive water management grant funds;

9. As of January 1, 2010, Water Code section 529.5 requires an urban water supplier that applies for financial assistance from the state for a wastewater treatment project, drinking water treatment project, or water use efficiency project, or a permit for a new or expanded water supply, to demonstrate that the applicant meets the water metering requirements of Division 1, Chapter 8, Article 3.5 of the Water Code; and
10. On May 12, 2011, the County certified that it is not an urban water supplier, as that term is understood pursuant to the provisions of section 529.5 of the Water Code.

APPROVALS

Using the authority delegated by the State Water Board on December 4, 2007, in Resolution No. 2007-0066, I hereby:

Approve an FPG for the Study for 50 percent of the eligible costs, not to exceed $75,000.

With the following conditions:

1. This PFC may be withdrawn if the County does not sign the WRFP grant agreement by December 17, 2011. Division staff may approve an extension of up to 120 days from the expiration date for good cause without further action by the Deputy Director of the Division; and
2. The WRFP grant agreement shall terminate if the County does not submit the final Study Report, including all associated documents within 2 years of the execution of this PFC. Division staff may approve an extension of up to 12 months for good cause without further action by the Deputy Director of the Division.

State Water Board action on this item will assist the Water Boards in reaching Goal 3 of the Strategic Plan Update: 2008-2012 to increase sustainable local water supplies available for meeting existing and future beneficial uses by 1,725,000 acre-feet per year, in excess of 2002 levels, by 2015, and ensure adequate flows for fish and wildlife habitat. In particular, approval of this item will assist in fulfilling Objective/Action 3.2 to increase the acceptance and promote the use of recycled water and sustainable water supplies consistent with the Climate Change Draft Scoping Plan developed pursuant to the California Global Warming Solutions Act of 2006 (AB 32) and other relevant State and regional efforts.

Preliminary Funding Commitment

James Maughan, Acting Deputy Director
Division of Financial Assistance

7/7/11
Date

SAN LUIS OBISPO COUNTY
DEPARTMENT OF PUBLIC WORKS
Paavo Ogren, Director

County Government Center, Room 207 • San Luis Obispo, CA 93408 • (805) 781-5252
Fax (805) 781-1229 email address: pwd@co.slo.ca.us

TO: **Board of Supervisors**

FROM: **John Waddell, Project Manager**

VIA: **Dave Flynn, Deputy Director of Public Works**

DATE: **July 26, 2011**

SUBJECT: **Approval of an Amendment to an Existing Agreement with Carollo Engineers for $101,859 for the Los Osos Wastewater Project, Los Osos**

Recommendation

It is our recommendation that your Honorable Board approve the attached Amendment No. 4 to an agreement for engineering consulting services with Carollo Engineers of Walnut Creek, CA, for $101,859 and direct your Board Chair to execute.

Discussion

On September 20, 2006, California State Governor Arnold Schwarzenegger signed Assembly Bill 2701 (Blakeslee) which allows the County, at the Board's discretion, to assume responsibility for development of a wastewater project (Project) for the community of Los Osos. Since 2006, environmental permits and funding approvals have been obtained, and on March 15, 2011, your Board adopted the Due Diligence resolution to assume responsibility for the Project and proceed to Project completion. The adoption of the Due Diligence resolution predicated your Board's action on May 17, 2011, to authorize the $173 million Project budget. The budget includes a $22 million interim funding loan, which has repaid the County's loans to the Project since 2006 and is funding the remaining pre-construction efforts.

The contract amendment with Carollo Engineers provides for technical engineering assistance for preparation of two water recycling reports that are required for the Project. The firm has been providing engineering consulting services to the County on the Project since 2007. Based on their knowledge and experience on recent Project efforts, specifically their recent experience to update water recycling design criteria, they are the most qualified firm to prepare these technical reports within the necessary time frame.

- Water Recycling Facility Plan: In January, 2011, your Board approved Amendment No. 3 to the existing agreement with Carollo Engineers which included a task item to update the 2008 Reuse and Disposal Technical Memorandum with the engineering details of the water recycling program approved in the Coastal Development Permit. This update was required to provide Project scope details for the collection system design agreement.

  After approval of the amendment, State Water Board staff informed the County that it is eligible to apply for up to $5 million in grants available through the Water Recycled Funding Program. The primary requirement of the application is an engineering report, referred to in the guidelines as a Facility Plan. Development of the Facility Plan will eliminate the need to update the 2008 technical memorandum, and staff directed Carollo Engineers to only develop the basic information required to complete the scope for the collection system design agreement but not to revise the technical memorandum. As a result, approximately $20,200 of the original $31,200 budgeted of this task remains available for preparation of the Facilities Plan.

  Additionally, the County was awarded a Water Recycling Facilities Planning Grant from the State Water Board on July 7, 2011, to fund 50% of the costs of preparing the Facility Plan. By applying the grant funds and savings from the prior Amendment No. 3, the resulting net cost increase to the Project for preparing the Facilities Plan is approximately $24,200.

- Title 22 Engineering Report: The Regional Water Board and CA Department of Public Health require water recycling projects under Title 22 of the CA Code of Regulations to apply for a Master Reclamation Permit. The permit applicant is required to develop an Engineering Report to describe how the project will comply with water recycling criteria. Many of the details of the Engineering Report are similar to the requirements in the Facilities Plan. However, a separate report is necessary in order to efficiently address the criteria of each agency. The scope of work for Carollo Engineers for this task assumes that much of the information developed for the Facility Plan will be incorporated into the Engineering Report, reducing redundant work efforts.

Other Agency Involvement/Impact

Numerous other agencies are involved in the Project. Other related efforts include preparation of a community Habitat Conservation Plan (Department of Planning and Building), an update to the Local Coastal Plan (Department of Planning and Building), and development of solutions to the community's groundwater basin overdraft which is causing sea water intrusion (Golden State Water, Los Osos Community Services District, and S&T Mutual Water Company under the jurisdiction of the San Luis Obispo County Superior Court).

- Coordination with potential recycled water users as required to document the Recycled Water Market per Appendix B, Item F.2 of the Water Recycling Funding Program Guidelines.
- Title 22 disinfected tertiary recycled water is assumed. The alternative level of treatment evaluation recommended by Appendix B Item G.2.a.i and Item G.2.c.i of the Water Recycling Funding Program Guidelines are not applicable and will not be prepared.
- Water conservation is required by the CDP and incorporated into the baseline assumptions for the water recycling analysis. Therefore, the water conservation/reduction analysis suggested by Appendix B Item G.3 of the Water Recycling Funding Program Guidelines is not applicable.
- Water recycling is required by the CDP and only one alternative is being considered by the County. Therefore, the suggested evaluation in Appendix B Item G.4, G.5 and G.7 of the Water Recycling Funding Program Guidelines is not applicable.
- The County will coordinate with water suppliers and potential users, as required, to complete Appendix B Item H.6 of the Water Recycling Funding Program Guidelines.
- The County will provide information as suggested in Appendix B Item I of the Water Recycling Funding Program Guidelines, as applicable.
- The County will provide letters of interest from potential recycled water users, draft recycled water mandatory use ordinance or model user contract, and draft necessary agreements for the Facility Plan Appendices, as applicable.

5. The Facility Plan Update work efforts will be incorporated into the Title 22 Engineering Report as required.
6. The County will develop detailed rules and regulations and customer training manual/information to be provided to the end users. Refer to the Engineering Report Guidelines, Sections 2.2 and 4.9, for requirements of the rules and regulations and customer training. Carollo will develop and include preliminary rules and regulations and customer training requirements in the draft and final report. This information will be based on previous recycled water projects (for other municipalities) and will be updated by the County, if necessary, as the Project progresses.
7. This Scope of Work does not include development of end user permits or any necessary permit coordination.
8. Work will be performed on a time and materials basis in recognition that the scope and level of effort required to provide these services may be modified by the County with little or no notice.
9. Project coordination and communication will generally be directed to occur between the County's Project Manager and Carollo's Project Manager.

i. Alternative levels of treatment.
ii. Alternative unit processes to achieve a given level of treatment.
b. Pipeline route alternatives.
c. Alternative markets:
i. Based on different levels of treatment.
ii. Geographical areas.
d. Alternative storage locations.
e. Sub alternatives of selected alternative:
i. Marginal analysis for selected alternative for certain categories of users or certain geographic areas.
ii. Varying storage, pump rates, and pipeline diameters.
iii. Use of water blending during peak irrigation months.

2. Non-recycled water alternatives.
a. Discussion of other potentially viable new sources of water.
b. Provide economic costs.
3. Water conservation/reduction analysis.
a. Analysis.
b. Impact on recycling, if any.
c. Recommendation.
d. Implementation.
4. Pollution control alternatives (if applicable) needed to comply with waste discharge requirements, and possible allocation of costs between recycling and pollution control.
5. No project alternative.
6. Information supplied for each alternative to include, but not be limited to:
a. Cost tables for each alternative with breakdown of costs by total capital (without grants), O&M, unit processes, and with equivalent annual cost and per acre-foot cost.
b. Lists of potential users assumed for each alternative.
c. Economic analysis.
d. Energy analysis for each alternative, including direct and construction energy.
e. Water quality impacts:
i. Effect on receiving water by removing or reducing discharge of effluent, including effect on beneficial uses resulting from reduced flow.
ii. Ground water impacts.
7. Comparison of above alternatives and recommendation of specific alternative.

H. Recommended Facilities Project Plan

1. Description of all proposed facilities and basis for selection.
2. Preliminary design criteria and refined pipeline routes.
3. Cost estimate based on time of construction.
4. List of all potential users, quantity of recycled water use, peak demand, and commitments obtained.
5. Reliability of facilities as compared to user requirements.
6. Implementation plan:
a. Coordination with water suppliers, determination of recycled water supplier and needed agreements or ordinances.

Los Osos ISJ Working Group
County of San Luis Obispo
Golden State Water Company
Los Osos Community Services District
S&T Mutual Water Company

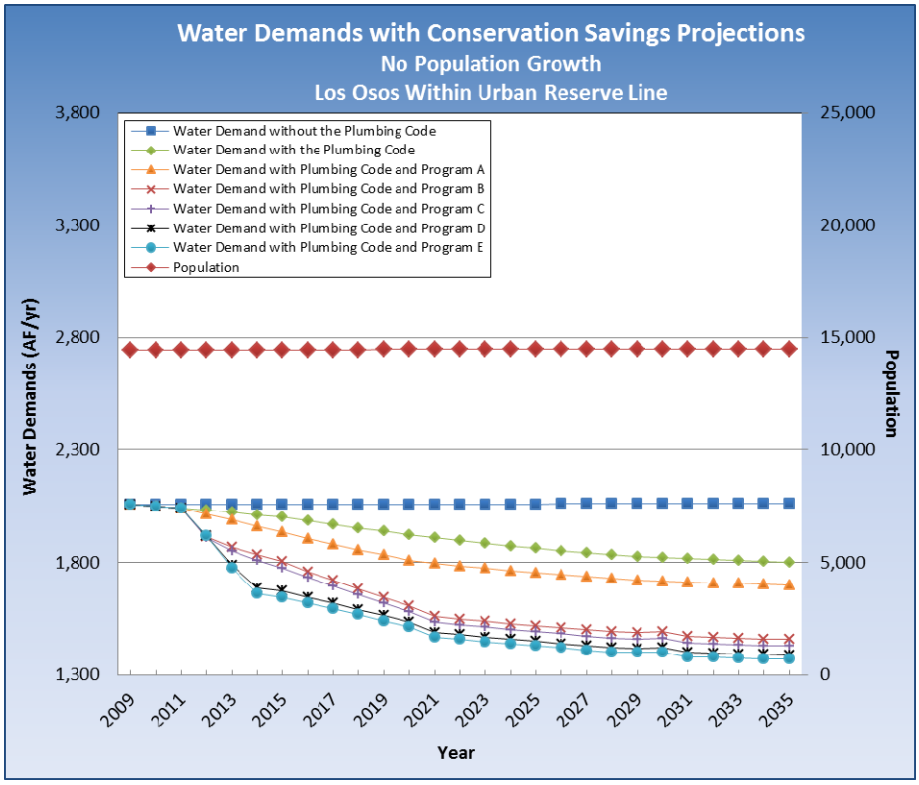
2011 Water Demand Analysis and Water Conservation Evaluation

ADMINISTRATIVE REVIEW DRAFT

April 5, 2011

MADDAUS WATER MANAGEMENT

Figure 3: Water Demands with Conservation Savings Projections (No Population Growth)



The present value cost for program B is about $1.3 million over the next twenty five years while the cost of Program C is $2.1 million as shown in Table 4 below. Program D (costing $1.6 million more than C) and Program E show the same water demand trend as Programs B and C but with a sharp decrease in water use in years 2013 and 2014 due to the subsidized retrofit measures. Program E yields a less than 1% improvement in water use reduction over Program D but costs an additional $600,000 over the next twenty five years to implement. Table 4 contains the benefits and costs of each program as well as the water savings in years 2015 and 2035. Percentage reductions in water use are relative to water demands without the plumbing code. It also contains the total cost of the programs over the twenty five year analysis period and the first five year costs for these programs.

Table 4: Economic Analysis of Alternative Programs

Economic Analysis of Alternative Programs
Los Osos Within Urban Reserve Line

Conservation Program	Water Utility Benefit-Cost Ratio	Community Benefit-Cost Ratio	2035 Water Savings (AF/Yr)	2035 Indoor Water Savings (AF/Yr)	2035 Outdoor Water Savings (AF/Yr)	Total Water Savings as a Percentage of Total Production in 2035	Present Value of Water Utility Costs	First Five Year Water Utility Cost (2012 - 2016)	Water Utility Cost of Water Saved ($/AF)
Without the Plumbing Code	NA	NA	0	0	0	0%	NA	NA	NA
With the Plumbing Code	NA	NA	353	323	0	14.5%	NA	NA	NA
Plumbing Code plus Program A	7.20	2.95	455	450	5	18.7%	$692,533	$468,919	$261
Plumbing Code plus Program B	12.25	2.18	697	532	165	28.6%	$1,287,919	$675,217	$151
Plumbing Code plus Program C	8.28	2.06	726	551	175	29.8%	$2,071,509	$1,154,872	$223
Plumbing Code plus Program D	5.30	2.08	775	600	175	31.8%	$3,866,083	$3,225,215	$355
Plumbing Code plus Program E	4.76	2.25	795	620	175	32.6%	$4,554,004	$4,038,904	$396

Note: The "Water Utility" refers to the agency or utility that is administering the measure. The community benefit to cost ratio includes the summation of the utility and customer benefits and costs.

HYDROGEOLOGIC INVESTIGATION

OF

THE BRODERSON SITE

PHASE 2 - IMPACTS ASSESSMENT

Prepared for the

LOS OSOS COMMUNITY SERVICES DISTRICT

NOVEMBER 2000

CLEATH & ASSOCIATES
1390 Oceanaire Drive
San Luis Obispo, California 93405

(805) 543-1413

occurs such that the wastewater has been sufficiently filtered to remove pathogens prior to the water reaching the edge of the Broderson site on the northern boundary adjacent to Highland Drive.

Travel times of actual water particles should not be confused with movement of pressure fronts and associated rising or declining water levels. Although it will take an estimated1year for water particles to move off site and at least 14 years to reach the bay, it will take less time for the ground water mound to begin developing for rising water levels to spread out from the site to the bay. The effect is similar to ocean waves, which travel along much faster than actual particles of sea water.

RECOMMENDED MAXIMUM DISPOSAL RATE

The results of the Horizon A analysis indicates that flows of at least 1.3 mgd, given enough area at the surface (13 acres), will percolate through Horizon A without daylighting at the site or downslope in the vadose zone. A critical assumption is made, however, that no interference occurs from the larger ground water mound created on top of the AT2 Clay. This is because if the deeper mound moves up into the perched zone, the amount of available head to drive the water through Horizon A will drop, causing the perched mound to rise. Therefore, the maximum height of the larger ground water mound rising beneath the site should not be designed to rise higher than the bottom of Horizon A, an average of about 40 feet beneath the site.

The disposal rate that meets the criteria for not rising into Horizon A would be **800,000 gallons per day (0.8 mgd)**. This rate would not be expected to cause the major ground water mound to rise to above 40 to 50 feet beneath ground surface (Figure3). The infiltration area should cover at least 7 acres to avoid mounding issues on Horizon A, and be as long as possible (east to west, parallel to the slope).

IMPACTS AND MITIGATIONS

Liquefaction Potential

Liquefaction occurs when a cohesionless soil temporarily becomes fluid due to a sudden rise in pore pressure, often associated with seismic waves from earthquakes. The result of liquefaction is that buildings and other structures can become unstable and cause damage. Prior work by Fugro West (1996) identified potentially liquefiable soils in the subsurface, both at the Broderson site and other areas in the community. All of the 17 cone penetrometer tests performed reported soils subject to liquefaction if saturated. The 1996 Fugro study reports:

> "The Phase 1 modeling by M&E indicates that ground water levels should not rise above a depth of about 80 feet below ground surface in the vicinity of the Broderson spreading site. However, during the recharge process, there is water in transit between the point of spreading and the ground water table surface. If the rate of infiltration locally exceeds the soil permeability, then localized perched water conditions could result. If that perched water condition occurs at depth that is susceptible to liquefaction, there may be an associated hazard for structures positioned above that location."

The potentially liquefiable intervals identified at the Broderson site corresponded to the first 6 to 10 feet of dune sand and to Horizon A. Despite a maximum setback, there will be an increase potential for liquefaction beneath residences immediately downslope of the infiltration area, based on the possibility for Horizon A to saturate as perched water moves offsite. The value for estimated maximum saturated thicknesses using the modeled mound is less than one foot of saturation at an average 40 feet depth beneath the closest residences, however, Horizon A will become saturated offsite, and the potential for liquefaction of this horizon will exist in an area where it did not before. Even if greater setbacks were used or lower disposal rates were used, Horizon A will still potentially be saturated off-site to the north.

Surfacing Ground Water near the Bay

Water levels near the bay downslope from the Broderson site are expected to rise in response to disposal operations. The area where surfacing ground water may increase as a result of the proposed project and the mitigation measures which could be enacted are discussed below.

Surfacing Water Impact Area

As the wastewater migrates from the site, ground water levels will rise along and in front of its flow path. The rising ground water level remains below ground surface for most of the distance to the bay, but can be expected to reach ground surface or within 5 feet of ground surface about 1,000 feet from the bay. This line approximately follows the 20 foot ground surface elevation above mean sea level contour at a distance of about 3,500 feet from the Broderson property disposal field. Historic water levels in shallow wells in the area between the 20 foot contour and the bay have been less than 10 feet below ground surface. Therefore, mitigation measures should be considered to prevent ground water from surfacing in this area.

Down gradient from the Broderson site, there are several water wells used for ground water production from the shallow aquifer above the AT2 clay layer. These wells are located along Pecho Road from Los Osos Valley Road to Skyline Drive. Two private wells are immediately adjacent to the intersection of Pecho and Los Osos Valley Road. North of Los Osos Valley Road, S& T Mutual Water Company and California Cities Water Company have shallow wells (S&T Well #1 and the Cal Cities Skyline well). The golf course also has a shallow well. The operation of these wells should be capable of maintaining low

Appendix E-1 Expanded Drainage and Surface Water Quality Analysis Page 5.3-91

The significance determination regarding project-specific level of significance after mitigation for Proposed Projects 1 through 4 of Appendix E-1, Expanded Drainage and Surface Water Quality Analysis, is revised as follows:

Project-Specific
Proposed Projects 1 through 4
~~Less than Significant~~ No Impact.

Appendix F-1 Expanded Geology Analysis Page 5.4-17

The mitigation measures identified for Proposed Projects 1 through 4 under cumulative of Appendix F-1, Expanded Geology Analysis, is revised as follows:

Cumulative
Proposed Projects 1 through 4
~~Implementation of Mitigation Measures 5.4-B1 is required~~ No mitigation measures are required.

Appendix F-1 Expanded Geology Analysis Page 5.4-18

The significance determination regarding cumulative level of significance after mitigation for Proposed Projects 1 through 4 of Appendix F-1, Expanded Geology Analysis, is revised as follows:

Cumulative
Proposed Projects 1 through 4
~~Less than Significant~~ No Impact.

Appendix F-1 Expanded Geology Analysis Page 5.4-29

Mitigation Measure 53.4-G1is revised as follows:

5.4-G1 Prior to approval of improvement and building plans for the proposed collection system facilities, ~~and~~ facilities at the treatment plant site, and facilities at Broderson, a design-level geotechnical report shall be prepared that addresses and reduces potential expansive soil impacts to less than significant. The expansive soil data shall be used with the requirements of the California Building Code (2007), as adopted by the County of San Luis Obispo.

State Water Resources Control Board

Division of Financial Assistance
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Mailing Address: P.O. Box 944212 • Sacramento, California 94244-2120
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Linda S. Adams
Acting Secretary for Environmental Protection

Edmund G. Brown, Jr.
Governor

DIVISION OF FINANCIAL ASSISTANCE (DIVISION)
FACILITY PLAN APPROVAL (FPA)
CLEAN WATER STATE REVOLVING FUND (CWSRF) PROGRAM;
COUNTY OF SAN LUIS OBISPO (COUNTY);
LOS OSOS WASTEWATER PROJECT (PROJECT);
CWSRF PROJECT NO. C-06-5230

CERTIFIED MAIL NO.: 7003-3110-0003-0772-7405
Return Receipt Requested

Paavo Ogren, Director of Public Works
County of San Luis Obispo
Room 207
County Government Center
San Luis Obispo, CA 93408

Dear Mr. Ogren:

Division staff prepared this FPA based on the County's Financial Assistance Application and supporting documents. The FPA documents our understanding of the County's Project, and the conditions that will apply to the financing agreement for the Project. You must agree with this FPA before we can proceed with funding the Project.

This FPA constitutes a final staff decision. The FPA does not reserve funds for your Project and it is not the financing agreement. After the Division receives the County's agreement on the eligibility decisions, schedule, and conditions in this FPA, the Project Manager will request approval of a Preliminary Funding Commitment (PFC) for your Project by the State Water Resources Control Board (State Water Board). After the State Water Board approves the PFC, the initial financing agreement will be prepared and sent to the County for execution. To expedite this process, please sign in the space provided below and return to your Project Manager immediately at:

Mr. Kyle Ochenduszko, P.E.
Project Manager
Division of Financial Assistance
P.O. Box 944212
Sacramento, CA 94244-2120
Phone: (916) 341-5693
E-mail: kochenduszko@waterboards.ca.gov

For your convenience, a sample CWSRF agreement template is available online at:
http://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/docs/cwsrf/cwsrf_cntrct_tmplte.pdf

If you do NOT agree with this FPA, then you must request a Final Division Decision within ten working days from the date the Assistant Deputy Director approved the FPA in the signature block below. Your request should specify the items of disagreement and suggest the exact changes with which you will agree. Please send the request to:

Mr. Esteban Almanza, Deputy Director
Division of Financial Assistance
P.O. Box 944212
Sacramento, CA 94244-2120

DIVISION STAFF APPROVAL

Sign Here: James Maughan, Assistant Deputy Director
Division of Financial Assistance

2/10/2011
Date

APPLICANT AGREEMENT

Using the authority delegated by the County on January 6, 2009, in Resolution No. 2009-0020, I hereby agree, on behalf of the County, with the content and conditions of this CWSRF FPA for Project No. C-06-5230 and have reviewed the draft financing agreement template.

Sign Here: Paavo Ogren
Director of Public Works
County of San Luis Obispo

2/10/2011
Date

POLICY AND GUIDELINES

Policy for Implementing the CWSRF for Construction of Wastewater Treatment Facilities (Policy) amended March 17, 2009.

TYPE OF FUNDING REQUESTED

The County is requesting grants, principal forgiveness, and/or low interest financing through programs administered by the Division.

TOTAL PROJECT COST	STATE WATER BOARD FUNDING REQUEST
$189,033,416	$86,208,416

TECHNICAL REVIEW

PROJECT LOCATION

The proposed Project will be constructed within the community of Los Osos in San Luis Obispo County, located at the southern edge of Morro Bay. The proposed Project service area is within the Los Osos Groundwater Basin (Basin) and is roughly equivalent to the "Prohibition Zone" established in 1983 by the Central Coast Regional Water Quality Control Board (Central Coast Regional Water Board) Resolution No. 83-13. The Project service area almost completely encompasses the community of Los Osos.

EXISTING FACILITIES

The proposed Project is a communitywide septic to sewer project. There are roughly 4,000 individual septic tanks and a number of small neighborhood collection and septic systems that will be included in the proposed Project. These small neighborhood systems are located at four mobile home parks and the subdivisions of Vista De Oro and Bayridge Estates. In 2005, a small amount of collection system lines (roughly 3,000 lineal feet) were constructed that may be incorporated into the proposed Project.

PROJECT OBJECTIVES

Water quality data collected by the Central Coast Regional Water Board revealed elevated levels of nitrate present in the Basin's upper aquifer, within the boundaries of the Project service area, that threaten drinking groundwater quality. The purpose of the Project is to restore and protect water quality in the Los Osos area, consistent with waste discharge requirements (WDR), resolutions, and enforcement orders of the Central Coast Regional Water Board. This objective is consistent with the California Coastal Commission's permit requiring the Project to address drinking water quality impairment in the Basin's upper aquifer.

The Project will offset potable water use in the Basin with California Title 22 disinfected, tertiary treated recycled water. Recycled water will be used for urban and agricultural irrigation at sites that currently rely on potable water.

Impaired water quality has been documented in the Basin for more than 30 years. This is the third attempt to build a project to address water quality issues in the Basin. The County started to design a wastewater collection and treatment project in the 1990's. The County's efforts stopped in 1999 when the Los Osos Community Services District (LOCSD) was established and took responsibility for wastewater in the community. The LOCSD started construction of a wastewater collection and treatment project with CWSRF financing in June 2005. In October 2005, the LOCSD stopped the project and subsequently filed bankruptcy. Since the bankruptcy and passage of Assembly Bill 2701 (Blakeslee), the County has been conducting studies to determine the feasibility to construct and operate a wastewater collection and treatment system.

PROJECT DESCRIPTION

The proposed Project involves the construction of a wastewater collection system including pump stations with standby power facilities, a wastewater treatment plant, recycled water systems, and effluent disposal facilities. The County submitted a complete Project Report (*Los Osos Wastewater Project Preliminary Engineering Report, May 2010*) on May 19, 2010, which was used as the basis for the Project description below.

The collection system design will be based on the LOCSD 2004 design, with the exception of changes required to convey wastewater to a new treatment plant site outside the community. There will be 219,360 lineal feet of pipe (roughly 41.5 miles), nine major pump stations, and 13 neighborhood "pocket" pump stations. Wastewater will be collected at the Mid-Town Triplex Pump Station and sent, under pressure, to the treatment facility east of the community.

The treatment facility will be located out of town on the 38 acre Giacomazzi property north of Los Osos Valley Road. The treatment plant will be designed to accommodate a daily average flow of 1.2 million gallons per day (MGD). The treatment facility is sized for a community build out population of 19,713 persons. Tertiary treated wastewater effluent will be filtered to be used for unrestricted reuse pursuant to California Title 22 regulations. Components of the treatment facility are listed below:

- Headworks facility and odor control systems
- Extended aeration secondary treatment processes
- Secondary clarifiers
- Return/waste activated sludge pump station
- Tertiary filtration system
- Disinfection facilities
- Mechanical dewatering system
- Recycled water storage, pump station, and distribution system
- Administrative building
- Maintenance facilities
- Emergency peak flow retention basin

Effluent from the wastewater treatment facility will be reused to the maximum extent possible throughout the community for irrigation; the remaining effluent will be discharged through leachfields. Recycled water will be used for urban irrigation at schools, parks, golf courses, and the cemetery within the Project area. Agricultural irrigation turnouts will be provided to farmers adjacent to the Los Osos urban area. The existing leachfield at Bayridge Estates will be used for disposal. Eight acres of leachfields at the Broderson site will be also available for discharge and disposal. Mitigation measures for the Project are stated in the Special Conditions Section of this FPA by reference.

The County is not the water purveyor for the Project service area. Water is supplied by the LOCSD, Golden State Water Company, and S&T Mutual Water Company. Neither water purveyor is classified as an urban water supplier; each purveyor has less than 3,000 connections and delivers less than 3,000 acre-feet of water per year. Neither agency needs to submit an Urban Water Management Plan to the Department of Water Resources; Assembly Bills 1420 (Laird) and 2572 (Kehoe) do not apply.

The Project is listed on the State Fiscal Year (SFY) 2010/2011 CWSRF Project Priority List

The Project is listed in the CWSRF Intended Use Plan for SFY 2010/2011

The Project is routine, non-controversial based on documents and communications with the County: _____ Yes ___X___ No

CWSRF PROJECT COSTS

Below is a table that outlines the estimated Project cost for the County's Project:

TYPE OF WORK	ESTIMATED COSTS
Refinance Existing Los Osos Community Services District Debt	$6,288,416
Construction	$79,920,000
Allowances (Soft Costs) *	
1. Planning	$0
2. Design	$0
3. Construction Management	$0
4. Administration	$0
Subtotal of Allowances	$0
TOTAL	**$86,208,416**

** Allowances are an eligible type of cost, but allowances are assumed to be financed by the United States Department of Agriculture Rural Development.*

ELIGIBLE COSTS

The items listed below are eligible for CWSRF financing. Detailed Project component eligibility and eligible component size will be determined during the review of the final Plans and Specifications (P&S) as part of the Approval of Award (AOA), and will be consistent with this FPA.

- Headworks facility and odor control systems
- Extended aeration secondary treatment processes
- Secondary clarifiers
- Return/ waste activated sludge pump station
- Tertiary filtration system
- Disinfection facilities
- Mechanical dewatering system
- Recycled water storage and pump station
- Administrative building
- Maintenance facilities
- Emergency peak flow retention basin
- Collection system piping
- Pump stations
- Standby power facilities for pump stations and the treatment works
- Site preparation, access, or security improvements
- Pumps, piping & valves
- Process control equipment
- Relocate/Demolish/Remodel existing buildings as needed for installation of new facilities
- Allowances (soft costs) for administration, planning, design, and construction management
- Mitigation measures mandated by state and/or federal agencies

INELIGIBLE COSTS

Listed below is a list of ineligible costs. Detailed Project component eligibility and eligible component size will be determined during the review of the final Plans and Specifications (P&S) as part of the Approval of Award (AOA), and will be consistent with this FPA.

- Land, construction on private land, and property rights of way
- Construction costs prior to the issuance of the PFC by the State Water Board
- Construction change orders and claims exceeding the amount of the financing agreement(s)
- Decorative items (artwork, sculptures, reflective ponds, etc.)
- Construction contingencies
- Operation and maintenance costs and extended warranties for equipment
- Act of God insurance costs
- Portable furniture and appliances
- Demolition or decommission of existing facilities NOT required to provide space for eligible new facilities
- All other items not included in the construction contract except approved allowances

ELIGIBLE DESIGN PARAMETERS

The Project's eligible design parameters will be consistent with WDR to be issued by the Central Coast Regional Water Board. A table of estimated eligible design parameters is provided below, but will be superseded by final WDR adopted by the Central Coast Regional Water Board:

PARAMETER	VALUE
Population Served	13,538
Average Dry Weather Design Flow	1.2 MGD*
Effluent Settleable Solids	0.1 mg/l**
Effluent Biochemical Oxygen Demand (5-Day)	60 milligrams/liter (mg/l) **
Effluent Suspended Solids	60 mg/l **
Effluent Total Nitrogen (as Nitrogen)	7 mg/l **

* Source: *Los Osos Wastewater Project Preliminary Engineering Report, May 2010*

** Source: WDR Order No. R3-2003-0007

PROJECT SCHEDULE

This tentative schedule does not supersede any regulatory enforcement schedule. Special attention to the Project milestones schedule is critical. Schedules must be compatible with requirements of the Central Coast Regional Water Board enforcement actions related to the planned facilities. Approval of a schedule not compatible with the Central Coast Regional Water Board requirements does not relieve the County of its responsibility to achieve compliance.

COUNTY MILESTONES	SCHEDULED DATE
Collection System and Recycled Water Distribution System	
Advertise for Bids	August 31, 2011
Open Bids	October 31, 2011
Submit AOA Package	October 31, 2011
Start Construction (Notice to Proceed)	November 30, 2011
Completion of Construction	November 28, 2014
Initiation of Operations	December 31, 2014
Performance Certification & Project Performance Report	December 31, 2015
Wastewater Treatment System	
Issue Request for Proposals	September 30, 2011
Award a Design-Build Team	November 30, 2011
Submit AOA Package	November 30, 2011
Start Design/Construction	December 30, 2011
Completion of Construction	November 28, 2014
Initiation of Operations	December 31, 2014
Performance Certification & Project Performance Report	December 31, 2015

ENVIRONMENTAL REVIEW

State Water Board and United States Department of Agriculture (USDA) Rural Development jointly conducted a Tier I environmental review for the Project. State Water Board staff determined that the Project will not result in any significant adverse water quality impacts. Special conditions will be included in Exhibit D of the County's financing agreements to ensure compliance with the federal Endangered Species Act and the National Historic Preservation Act.

The County prepared an Environmental Impact Report (EIR) for the Project. The County distributed the EIR to the public and circulated it through the State Clearinghouse; No. 2007121034 for public review from November 19, 2008, through January 30, 2009. The County received 14 agency letters and 60 letters from citizens, community groups, non-government organizations and other interested parties.

The County responded to all comments and made changes to the EIR where appropriate. The County certified the EIR, approved the Project, and adopted a Mitigation Monitoring Program and a Statement of Overriding Considerations (SOC), on September 29, 2009. The SOC was to substantiate the County's decision to approve the Project despite significant unavoidable impacts to 22 acres of locally important farmland. The County filed a Notice of Determination with the San Luis Obispo County Clerk on September 30, 2009, and with the Governor's Office of Planning and Research on October 5, 2009.

FINANCIAL AND FISCAL REVIEW

FINANCIAL ANALYSIS

A credit review analyzed the County's ability to enter into a financing agreement for the amount of $86,208,416 for construction and allowance costs. The credit review provided recommendations regarding the financing agreement terms, maximum CWSRF financing amount, financial capacity, and reserve fund requirements for the financing agreement.

The Project's service area has an estimated median household income (MHI) of $60,553; approximately one hundred and one percent (101%) of the State of California MHI. The Project service area qualifies as a disadvantaged community (DAC) based on CWSRF Policy Section X.D.2.: the monthly wastewater rates exceed 4% of the Project service area's MHI. The Project is eligible for DAC incentives offered by the CWSRF.

On October 26, 2010, the County introduced an ordinance establishing a mandatory sewer connection requirement and sewer service charges for the Project (Ordinance). Subsequently town-hall meetings were held and public notices were sent to the Project service area. At a public hearing on December 14, 2010 the Ordinance was adopted. Estimated monthly wastewater rates are listed below:

Construction Financing for Private Laterals	$44.00
Rates and Charges	$88.96
Assessments	$105.49
Total	**$238.45**

The total estimated Project cost is $189,033,416 which includes the following:

Construction Cost	$126,364,000
Eligible Soft Costs/Allowances	$26,110,000
Contingencies	$12,636,000
Loan #4014-110	$6,288,416
Ineligible Items	
Land purchase	$2,000,000
Construction on Private Land	$15,635,000
Total	**$189,033,416**

The Project is to be financed with a combination of grant and loan funds from USDA and CWSRF. An estimated summary of the sources of funds is listed below.

USDA Loan	$83,129,000
USDA Grant	$4,061,000
Subtotal USDA Share	$87,190,000
CWSRF Refinanced Financing Agreement	$6,288,416
CWSRF Financing Agreement	$72,420,000
CWSRF Principal Forgiveness	$7,500,000
Subtotal Water Board Share	$86,208,416
Owner Financed (Construction on Private Land)	$15,635,000
Total	**$189,033,416**

Projected monthly costs and annual revenues per user type are summarized below. The assessment figures are based on County Assessment #1 and the service charge portion is based on the setting of monthly service charges using the Proposition 218 process.

User Type	Users	Average Monthly Assessment Fees	Annual Assessment Fees	Average Annual Assessment Revenues	Average Service Charge + Flow	Average Annual Charges + Flow	Service Charge Annual Revenue	Total Average Monthly Charges	Total Annual Gross Revenues
Residential	4,289	$105.49	$1,265.88	$5,429,359.32	$88.61	$1,063.32	$4,560,579.00	$194.10	$9,989,938
Multi Family	809	$83.95	$1,007.40	$814,986.60	$36.64	$439.68	$355,701.12	$120.59	$1,170,688
Mobile Homes	542	$31.16	$373.92	$202,664.64	$24.44	$293.28	$158,957.76	$55.60	$361,622
Non-Residential	169	$121.65	$1,459.80	$246,706.20	$61.13	$733.56	$123,971.64	$182.78	$370,678
Total	5,809			$6,693,716.76			$5,199,209.52		$11,892,926

Based on the projected gross revenues and allowing for the operations and maintenance costs, estimated at $2,370,000 per year, the net revenues available for debt service would be approximately $9,527,927.

SECURITY AND SOURCE OF FINANCING REPAYMENT

The County of San Luis Obispo Assessment District No. 1 shall dedicate the County Assessment #1 and net revenues of the wastewater system including, but not limited to, wastewater rates and charges, and recycled water revenues, if any, to the repayment of the financing agreement. Prepayment of the assessment on any parcel shall decrease the CWSRF financing agreement amount, as the County will apply such assessments directly to project costs. The County also proposes to establish an assessment district to include undeveloped properties in the Project service area. Revenues from this proposed assessment shall also be dedicated to the repayment of the financing agreement.

Assuming a financing agreement for the amount of $78,708,416 for a term of twenty years at an estimated interest rate of 2.60%, the annual debt service will be $5,096,735. When added to the USDA debt service of $3,737,229 the result is total maximum debt service of $8,833,964. When total debt service is compared to net revenues the result is 1.08 times coverage. This does not meet the CWSRF requirement that net revenues be at least 1.10 times total debt service.

As a DAC with wastewater rates exceeding 4% of the Project service area's MHI, the community qualifies for extended term financing. Assuming a financing agreement for the amount of $78,708,416 for a term of thirty years at an estimated interest rate of 2.60%, the annual debt service will be $3,810,822. When added to the USDA debt service of $3,737,229 the result is a total maximum debt service of $7,548,051. When total debt service is compared to net revenues the result is 1.26 times coverage. This exceeds the CWSRF requirement that net revenues be at least 1.10 times the total maximum debt service.

It should also be noted that the County is proposing to repay approximately half of this financing with monies derived from an assessment district; these assessments will begin to be collected upon passage of a Due Diligence resolution by the County and before a financing agreement will be executed between the State Water Board and the County. CWSRF debt backed by assessment district funds will be on parity with USDA's debt backed by assessment district

funds. The other half of the financing will be secured by future rates and charges to be collected upon Project completion.

COMPARATIVE REVENUE AND EXPENSE ANALYSIS

The revenues and expenses for the County projections are summarized below:

Fiscal Year	2015/16 Projections @ 20 year term	2015/16 Projections @ 30 year term
Operating Revenues (Service Charges)	$5,199,210	$5,199,210
Special Tax & Assessment Revenue	$6,693,717	$6,693,717
Total Revenues	$11,892,927	$11,892,927
Operating Expenses	$2,370,000	$2,370,000
Net Available for Debt Service	$9,522,927	$9,522,927
USDA Loan Debt Service	$3,737,229	$3,737,229
Proposed CWSRF Debt Service	$5,096,735	$3,810,822
Total Debt Service	$8,833,964	$7,548,051
Debt Service Coverage	1.08	1.26

The County shall also establish a reserve fund equal to one year's debt service from available cash prior to construction completion. A reserve fund in the amount of one year's debt service is maintained so that in the event of non-payment, there are funds available to make the payment.

The independent credit review raised questions about the ability of the community to repay the financing agreement through the assessment and monthly service charges. The Division is mindful of AB 2701 (Blakeslee) in its recommendation that the State Water Board approve funding for the Project. The current septic tank discharges from Los Osos have created serious environmental and public health problems. State and Federal agencies have been working to address these issues in Los Osos for over thirty years. The Division believes the County has the resources and expertise necessary to construct the wastewater collection and treatment system to address the water quality issues in Los Osos. The transfer of the responsibility for constructing the plant to the County of San Luis Obispo is the viable solution to addressing and solving this problem.

A statement of fiscal impact to the CWSRF fund is included below:

(as of 01/13/2011)	SFY 2010-11	SFY 2011-12	SFY 2012-13	SFY 2013-14	SFY 2014-15
Beginning Balance:	$405,559,109.06	$114,434,733.56	$133,143,214.16	$265,029,923.26	$466,888,135.05
Estimated Repayments	$245,486,249.13	$255,486,249.13	$265,486,249.13	$275,486,249.13	$285,486,249.13
Debt Service on Revenue Bonds	($31,456,428.75)	($30,228,203.75)	($27,714,203.75)	($23,821,828.75)	($20,986,278.75)
Estimated Capitalization Grants	$67,144,221.00	$133,230,720.00	$28,800,000.00	$28,800,000.00	$28,800,000.00
Local Match Credits	$8,846,816.10	$1,377,697.22	$2,286,050.72	$912,290.41	$953,758.07
Est. SMIF Interest:	$2,700,000.00	$3,000,000.00	$3,000,000.00	$3,000,000.00	$3,000,000.00
Estimated Disbursements	($560,922,679.00)	($275,185,416.00)	($86,853,202.00)	($50,161,719.00)	($23,209,418.00)
Subtotal	**$137,357,287.56**	**$202,115,780.16**	**$316,346,108.26**	**$489,244,915.05**	**$740,932,445.51**
City of Redding, #4971-230 **(01/05/2011)**	($4,407,893.00)	($4,000,000.00)			
City of Redding, #4971-240 **(01/05/2011)**		($10,205,000.00)	($13,760,000.00)		
City of Redding, #4971-260 **(01/05/2011)**		($246,530.00)	($4,503,470.00)		
Sunnyslope County Water District, #5160-110 **(06/23/2010, 08/23/10**	($5,096,689.00)	($7,829,260.00)			
Union Sanitary District, #5222-110 **(01/05/2011)**	($1,114,416.00)	($4,853,988.00)	($225,767.00)		
County of San Luis Obispo (Los Osos Wastewater Pr.), #5230-110 **(01/13/2011)**			($29,276,046.00)	($21,034,728.00)	($18,041,310.00)
City of Seal Beach, #5310-110 **(10/07/10)**	($75,000.00)	($1,300,000.00)	($300,000.00)		
City of Seal Beach, #5310-120 **(11/15/10)**	($75,000.00)	($1,300,000.00)	($700,000.00)		
Eastern Municipal Water District (Temecula Valley), #5312-110 **(11/3**	($3,743,578.00)	($10,605,788.00)	($9,924,264.00)	($1,342,052.00)	
Inland Empire Utilities Agency, #5319-110 **(12/07/2010)**	($6,500,000.00)	($13,800,000.00)	($4,308,638.00)		
Inland Empire Utilities Agency, #5333-110 **(10/25/2010)**	($1,510,000.00)	($13,000,000.00)	($320,000.00)		
City of Lathrop, #5599-110 **(01/13/2011)**	($400,000.00)	($600,000.00)			
Susanville Sanitary District, #5727-110 **(11/18/2010)**		($1,232,000.00)			
	$114,434,733.56	**$133,143,214.16**	**$265,029,923.26**	**$466,888,135.05**	**$722,891,135.51**

LEGAL REVIEW

AB 2701 (Blakeslee) authorizes the County to undertake any efforts necessary to construct and operate a wastewater collection and treatment system to meet the needs of the LOCSD and to impose and collect user fees and other charges to cover the reasonable costs of any wastewater collection or treatment services provided pursuant to certain provisions. Governor Schwarzenegger's signing message directed the State Water Board to withhold any subsequent CWSRF loan to the County for the Project unless the outstanding $6.5 million loan to the LOCSD has been repaid or the payment plan incorporates its full recovery. The balance of that loan has been reduced to $6,288,416 due to the settlement of one of the State Water Board's claims. As part of this Project, the County will collect funds on behalf of the community of Los Osos to repay the existing $6,288,416 loan with the LOCSD.

AB 2701 also authorizes the Board of Supervisors of San Luis Obispo County to prepare and submit a proposed assessment to pay for the facilities, and, if certain requirements are met, to decide whether to proceed with construction of the Project. The County has not yet passed a resolution stating that it will construct and operate the Project (the Due Diligence Resolution) pursuant to AB 2701. Until it does, it may not begin collecting assessments.

The County has not submitted a number of items required pursuant to the CWSRF Policy, including a final agency resolution authorizing a County representative to execute the financing agreement, a legal opinion on access and ownership of the Project property, a certification of compliance with federal laws and authorities, a dedicated source of revenue resolution, an attorney certification with regard to Proposition 218 compliance, an attorney certification regarding litigation/audits/disputes, AB 2572 non-applicability certification, and information regarding existing debts.

SPECIAL CONDITIONS

1. This FPA includes only the Project described above and does not include any associated projects that may have been referred to in the County's Los Osos Wastewater Project Preliminary Engineering Report, dated May 2010. This approval does not guarantee that a financing agreement will be awarded to this Project;

2. In accordance with the Governor's signing message of AB 2701 (Blakeslee), this Project will repay the outstanding $6,288,416 owed by the LOCSD to the CWSRF;

3. The Project will be in compliance with the following:
   a. USDA letter of conditions, dated September 16, 2010
   b. Coastal Development Permit issued on September 7, 2010 by the California Coastal Commission
   c. Final Biological Opinion issued by the USFWS
   d. Memorandum of Agreement between the State Water Board, USDA, County, and the California State Historic Preservation Officer executed July 24, 2010

4. The Project will be in compliance with the final WDR issued by the Central Coast Regional Water Board;

5. The following items shall be submitted before the financing agreement is executed by the State Water Board:
   a. Authorized Representative Resolution
   b. Tax Questionnaire
   c. Dedicated Source of Revenue Resolution
   d. Updated Schedule of System Obligations
   e. Certificate of Compliance with Federal Laws and Authorities
   f. General Plan Compliance Certificate
   g. Letter of litigation, adverse audit findings, or ratepayer/contractor disputes (Policy Section IX.E.4)
   h. Bond counsel letter stating the relationship between the County Assessment District #1 and LOCSD assessment district
   i. Certification of AB 2572 non-applicability
   j. Economic analysis for the selected alternative in compliance with the Water Recycling Funding Program Guidelines
   k. Formal request by the Authorized Representative for CWSRF principal forgiveness and addressing livability standards commensurate with the CWSRF Intended Use Plan 2010/2011
   l. Draft or final USDA financing agreement
   m. Bond counsel opinion with respect to proposed system obligations (Policy Section IX.E.5)

6. The following items shall be submitted before the final agreement is amended and construction funds are disbursed by the State Water Board:
   a. Statewide General Permit for Landscape Irrigation Uses of Municipal Recycled Water from either the State Water Board or the Central Coast Regional Water Board
   b. A copy of the Title 22 recycled water engineering report submitted to the Department of Public Health

c. Legal opinion of compliance with Articles XIII C and XIII D of the California State Constitution (Proposition 218)
d. Legal opinion on access and ownership of land on which construction activities will take place
e. Final Water Conservation Plan
f. Final recycled water use assurances must be submitted prior to issuance of an AOA
g. The County must initiate the collection of County Assessment District No. 1 upon passage of a Due Diligence resolution by the County to allow for sufficient funds to be accumulated prior to the initial debt service due date

7. The CWSRF Financing Agreement shall be secured on parity with the USDA loan for County Assessment District No. 1 revenues;

8. The County shall establish a Reserve Fund equal to one year's debt service prior to the construction completion date;

9. The County shall covenant to establish rates and charges in amounts sufficient to generate net revenues equal to at least 1.10 times the total annual debt service;

10. Recipient may not incur future senior debt. Recipient future debt may be parity with CWSRF debt if Policy conditions are met (Policy Section X. G1);

11. The Financing Agreement shall be limited to a maximum of $86,208,416, of which an estimated $7,500,000 in CWSRF principal forgiveness. No more than $79,920,000 shall be disbursed to the County, the remainder of which will be amortized over the term of the financing agreement; unless new information supporting the credit review changes and a supplemental credit review is performed;

12. When the assessment district for undeveloped properties is formed and approved, the revenues must become an additional dedicated source of security for the proposed CWSRF financing agreement;

13. County Assessment District #1 property owners that wish to prepay their assessment may do so. Any prepayments received will reduce assessment backed principal borrowed from the CWSRF;

14. Grants and principal forgiveness provided by the State Water Board and any future source shall reduce the total CWSRF financing agreement amount;

15. The County must obtain a final, adopted WDR from the Central Coast Regional Water Board prior to construction;

16. The County may jeopardize State Water Board financing if construction begins prior to the PFC. Construction after the PFC and prior to issuance of the financing agreement is eligible for State Water Board financing;

17. The County must comply with the Disadvantaged Business Enterprise requirements and Davis-Bacon requirements;

18. The County will submit an AOA package after Project bid opening. The Division, through the AOA package, will use the Project bid results accepted by the County along with the final Project P&S to review final Project eligibility and performance standards. After review and approval, the Division will prepare a financing agreement consistent with the final eligibility determination and credit review. Signature of agreement by the County will constitute agreement with the Division's decisions on the AOA package,

19. The County must sign the financing agreement on or before June 30, 2011. Division staff may approve up to a 120-day extension for good cause;

20. The County must issue a notice-to-proceed for the Project no later than June 30, 2012. Division staff may approve up to a 120-day extension for good cause; and

21. To the best extent possible, USDA funds will be expended before CWSRF funds are disbursed.

DISTRIBUTION

Senator Sam Blakeslee
State Capitol
Room 4070
Sacramento, CA 94248-0001

Assembly Member Katcho Achadjian
State Capitol
Room 2016
Sacramento, CA 94249-0033

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S:\Funding Programs\SRF\Projects\San Luis Obispo, County of\Project Management\FPA\DRAFTS\No WRFP\02-07-2011_CWSRF_5230-110_FPAWWTPDFA Board PFC_KDO.DOC

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENT

Approved by USEPA: July 2003

CENTRAL COAST REGIONAL WATER QUALITY CONTROL BOARD

REGION	TYPE	NAME	CALWATER WATERSHED	POLLUTANT/STRESSOR	POTENTIAL SOURCES	TMDL PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
				Sedimentation/Siltation		**Medium**	**16 Miles**	
				Impaired section for Sediment/Siltation is located between the confluence with Church Creek and the confluence with Pajaro River (approximately 9.5 miles of stream length).				
					Agriculture			
					Hydromodification			
					Habitat Modification			
				Sodium		**Low**	**16 Miles**	
				Impaired section for Sodium is located downstream of confluence with Miller Slough (approximately 1 mile of stream near Southside Drive).				
					Source Unknown			
					Nonpoint Source			
				Total Dissolved Solids		**Low**	**16 Miles**	
				Impaired section for Total Dissolved Solids is located between the confluence with Church Creek and the confluence with Pajaro River (approximately 9.5 miles of stream length).				
					Nonpoint Source			
					Point Source			
3	**R**	**Lompico Creek**	**30412040**					
				Nutrients		**Low**	**4.5 Miles**	
					Septage Disposal			
				Pathogens		**Medium**	**4.5 Miles**	
					Septage Disposal			
					Natural Sources			
					Nonpoint Source			
				Sedimentation/Siltation		**High**	**4.5 Miles**	**2002**
					Construction/Land Development			
					Natural Sources			
3	**R**	**Los Osos Creek**	**31023012**					
				Fecal Coliform		**Low**	**9.9 Miles**	
					Source Unknown			
				Low Dissolved Oxygen		**Low**	**9.9 Miles**	
				This listing was made by USEPA.				
					Agriculture			
					Pasture Grazing-Riparian and/or Upland			
					Urban Runoff/Storm Sewers			
					Natural Sources			

GEOHYDROLOGY AND WATER QUALITY - BAYWOOD-LOS OSOS GROUNDWATER BASIN, SAN LUIS OBISPO COUNTY, CALIFORNIA

BY

RICHARD J. ZIPP
ASSOCIATE ENGINEERING GEOLOGIST
DIVISION OF PLANNING AND RESEARCH
STATE WATER RESOURCES CONTROL BOARD

OCTOBER 1979

SALTWATER INTRUSION

The Los Osos Basin has not been affected by saltwater intrusion. Chemical analyses of both municipal and domestic wells showed only one definitely intruded well.

Many factors have contributed to the nonintrusion of saltwater. Some of these are lack of overdraft, an apparent continuous clay cap of bay muds separating the producing aquifers from the bay, sufficient hydraulic head to keep saltwater out of the producing zones, and high horizontal compared to vertical transmissivities that have prevented large pumping cones from being generated.

Water level measurements made by San Luis Obispo County personnel in 1976 and again in 1979 indicate that the groundwater basin contains essentially the same amount of groundwater now as then. Comparison of the contour maps show there has been little change in overall water surface (Plates 6 and 7). As long as the existing water balance is not drastically altered, no significant intrusion should occur. The use of septic tank-leachfields for sewage disposal helps preserve this balance, but also ensures the maximum recycling of the basin's groundwater.

The water surface lowers to sea level at the coast. Inland the water surface is above sea level providing a positive hydraulic gradient toward the ocean. Several small pumping cones have been

generated by the larger capacity wells in the basin. None of these cones appear to be large enough or deep enough to create an intruding condition. The presence of the bay mud aquiclude and an adequate seaward hydraulic head allows the quality of the inland groundwater to be maintained. Movement of chloride ions through the bay mud probably occurs, but at present there is enough movement of the groundwater seaward to avoid a build up of chlorides. This is evidenced by the CSA No. 9 Third Street well which pumps on a continuous basis from a pumping level of approximately -50 feet below sea level. This well is no more than 30 feet from the bay, and the chloride level is no higher than most of the other wells in the basin. The lack of chlorides in the CSA No. 9 well may also be the result of sufficient seaward hydraulic head and/or the high horizontal to vertical ratio of permeabilities. As long as the hydraulic pressure in the shallow aquifer is not reduced enough to allow saltwater to migrate landward, no intrusion takes place.

If water can move horizontally into the well at a rate equivalent to the yield of the well, no cone of depression will develop which can induce the movement of saltwater into the well. This phenomenon seems to occur when the well yield is relatively low in comparison to what probably could be pumped. Also, this condition most likely is why nitrate-laden water is not induced in some of the deeper municipal wells.

Water quality analyses in the deeper wells in the basin do not contain a significantly higher concentration of chloride (Cl) than the shallower wells. For this reason, it has been assumed that a saltwater wedge has not intruded into the deep portions of the aquifer. If the wedge existed, there would be a definite potential for moving higher Cl waters vertically into the shallow pumping cones.

EXECUTIVE OFFICER
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
Central Coast Region
2036 Broad Street
San Luis Obispo, California 93401

STATE OF CALIFORNIA
The Resources Agency
DEPARTMENT OF WATER RESOURCES
Southern District

LOS OSOS-BAYWOOD GROUND WATER PROTECTION STUDY

District Report

October 1973

State of California **The Resources Agency**

Memorandum

To : California Regional Water Quality Control Board
Central Coast Region
2238 Broad Street
San Luis Obispo, CA 93401

Attention: Mr. Kenneth R. Jones
Executive Officer

Date :

File No.:

Subject: Los Osos-Baywood Ground Water Protection Study Report

From : **Department of Water Resources**
Los Angeles, CA 90055

In accordance with Interagency Agreement No. 1-5-014 between the State Water Resources Control Board (SWRCB) and the Department of Water Resources (DWR), we submit herewith 25 copies of the above report together with a reproducible master copy.

We wish to express our appreciation for the cooperation extended to us by your Board and Staff; the San Luis Obispo County Flood Control and Water Conservation District; the San Luis Obispo County Department of Health; the University of California's Agricultural Extension Service; the San Luis Obispo County's Farm Advisor's Office; the State Department of Health; the U. S. Soil Conservation Service; the Baywood Park County Water District; the California Cities Water Company; the Sunset Terrace Mutual Water Company; Brown & Caldwell Water Resources Engineers, Inc.; the water drillers who furnished us information; and several private individuals.

Jack J. Coe
Acting District Engineer
Southern District

Attachment

A result of conservation and/or direct use of surface water runoff would be a reduction in the freshwater outflow of Los Osos Creek to the Bay and marsh, which would affect the ecology. Because Morro Bay and the adjacent marsh are an important ecological and geographical feature in the coastal landscape, an impact study of the reduced flow should be considered in developing a water conservation program that would protect the environment.

Monitoring Program

The nature and location of monitoring depends on the plan selected and implemented. There is a need to monitor ground water elevations and quality to check such current potential quality problems as sea-water intrusion and waste disposal. Networks that could accomplish this and be compatible with the various plans should be selected after a field inspection has been conducted to determine the location and adequacy of existing wells.

However, during the interim period collection of water samples and water levels from municipal wells should be continued to determine changes in water quality and elevations.

6. KEY FINDINGS AND CONCLUSIONS

Changes in the disposal of domestic wastes could cause significant effects on the quantity and quality of the Los Osos Basin's water resources.

The key findings and conclusions of the study as they relate to changes that may occur are:

1. Urban growth has been rapid in recent years. Most of growth and its associated urban wastes have occurred in Subareas 1 and 2 (Plate 1). In 1972, the urban-suburban area covered 930 acres and irrigated agriculture, which has been developing and is mainly in Subarea 3, covered 750 acres.

2. The only source of municipal water is well water. In 1972, about 800 acre-feet were pumped for urban-suburban use and about 1,100 acre-feet for irrigated agricultural use.

3. Little water is used in Subareas 4 and 5, which are tributary to Subareas 1, 2, and 3. Except for a small alluviated section of Clark Valley, the area is essentially nonwater-bearing and is mostly covered with native vegetation.

4. Precipitation is an important natural source of water for the Basin. It amounts to an annual average of 20 inches in the tributary area (Subareas 4 and 5) and about 15 inches in the water-bearing areas (Subareas 1, 2, and 3). Total average annual volume of precipitation is about 27,000 acre-feet.

5. All the surface water from Subarea 4 and much from Subarea 5 flows into Los Osos Creek and Morro Bay. Annual flow to the Bay is estimated at 700 acre-feet if volume of precipitation is low, 2,700 acre-feet if it is average, and 7,300 acre-feet if it is high.

6. Alluvium in the upper Basin beginning about 1 mile east of Valley Park Cemetery is shallow -- from 20 to 30 feet deep -- and contains little usable ground water storage capability that can be depended upon for long-term carry-over storage. There is no significant surface water carry-over storage in the area.

7. The ground-water-bearing materials in the lower Basin (Subareas 1 and 2) contain most of the ground-water-storage capability of the whole Basin. The water-bearing materials thicken in a westward direction and are about 400 feet thick at Morro Bay.

8. Current water quality conditions in Subareas 3, 4, and 5, have had only a limited effect on Subareas 1 and 2. The old dune sand next to the alluvium in Los Osos Creek has low-to-moderate permeability. Consequently, much of the surface flows, especially flood flows, in the Creek discharge water to Morro Bay and are lost to the Basin.

9. About 800 acre-feet of ground water is pumped to meet the rapidly rising urban needs of the Los Osos-Baywood area. As a result, a pumping trough has developed below sea level in Subarea 1, thereby increasing the threat of sea-water intrusion.

10. Of the average annual amount extracted and applied, about 300 acre-feet returns from the area's septic tank-leach field systems to the ground-water Basin in the form of domestic waste water effluent. Percolation of domestic waste water minimizes the threat of sea-water intrusion because it aids in maintaining the ground water level in the vital area next to the Bay.

11. Percolation of domestic waste water effluent has degraded ground-water quality. The increase in NO_3 concentrations in parts of the area is a reliable indicator of the extent of degradation. The highest reported concentration was over 90 mg/l in Well No. 30S/10E-13G2 near Cuesta-by-the-Sea.

12. A potential source of supplemental water to the Basin is from the Recommended Water Supply System, contained in the "Report on Master Water and Sewerage Plan", May 1972, Camp, Dresser, and McKee. It includes the water in the Nacimiento Reservoir and the State Water Project as major sources, with Whale Rock Reservoir serving as a regulating reservoir.

The County is now using the Recommended Water Supply System as a guide in its negotiations with local agencies.

These key findings and conclusions underline the urgent need for complete management of the Los Osos Basin's water resources: its water supply; conservation; use; and treatment and disposal of waste water. Important elements of such a management plan should include, but not be limited to:

1. Conservation (including artificial recharge) and direct use of the flow in Los Osos Creek, now being wasted to Morro Bay, to supplement the ground-water supply in Subareas 1 and 2 in a comprehensive, coordinated manner.

2. Maintenance of watershed cover to enhance infiltration and conservation of runoff for subsequent underground storage of good quality water.

3. Dispersion of the extraction wells in the Subareas 1 and 2 on a comprehensive, coordinated basis to control ground water levels. The amounts and locations of extraction should be regulated to lessen the threat of sea-water intrusion and lessen subsurface and spring outflow from the Basin to the Bay.

4. Development of a plan for blending poor quality water with good quality ground water, imported water, or surface water or a combination of the three waters before delivery so as to minimize the public health problems caused by high NO_3 concentrations in water from some wells.

5. Determination of optimum disposal of domestic waste water effluent.

6. After selection of the management plan, establishment of a plan to monitor the quantity and quality of ground and surface water. This would also provide data on such current and potential water quality problems as sea-water intrusion and the effects of waste water disposal.

DRAFT

PHASE ONE - SEWERAGE PLANNING STUDY

CSA NO. 9 - LOS OSOS, BAYWOOD PARK, CUESTA-BY-THE-SEA

PREPARED FOR:

COUNTY ENGINEERING DEPARTMENT
SAN LUIS OBISPO COUNTY, CA.

MAY 1986

ENGINEERING-SCIENCE
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OFFICES IN PRINCIPAL CITIES

CENTRAL COASTAL REGIONAL WATER QUALITY CONTROL BOARD
RECEIVED
MAY 2 1986
LAUREL LANE
SAN LUIS OBISPO
CALIFORNIA

Draft

PHASE ONE -
SEWERAGE PLANNING STUDY, CSA NO. 9 -
LOS OSOS, BAYWOOD PARK, CUESTA-BY-THE-SEA

Prepared for

COUNTY ENGINEERING DEPARTMENT
San Luis Obispo County, CA

May 1986

Prepared by

ENGINEERING-SCIENCE
666 Camino Aguajito, Suite 202
Monterey, California 93940

- March 1984. A public hearing is held to discuss the Phase II report.
- September 1984. Brown and Caldwell issues a supplement to the Phase II report to address public and Regional Board comments and to revise the project EIR.
- February 1985. The Morro Group is retained by the County to prepare an EIR for the project.
- April 1985. Engineering-Science is retained by the County to perform a planning study (Phase I) and preliminary design (Phase II) for the sewerage project in coordination with the Morro Group.

The project history has included debates about the hydrogeologic characterististics of the groundwater basin, the merits of preserving the quality of the shallow groundwater which currently is not used as a primary water source, the potential for degradation of the deeper groundwater which is the primary water source for the area, and the use of other types of systems in lieu of a sewerage system to protect groundwater quality in the area. An ongoing concern of the County and of Los Osos/Baywood Park residents is the financial implication of an area-wide sewerage project. This financial implication was emphasized by the Phase II Facilities Plan user fee estimate of $60 per month. However, in light of the Regional Boards' 1983 amendment to the Basin Plan, a sewerage project appears inevitable. This Phase I Planning Study has therefore been undertaken to determine the most cost-effective sewerage system to serve the area.

AUTHORIZATION

On 12 March 1985, the County Board of Supervisors authorized the County Engineer to proceed with negotiations with Engineering-Science (ES) for an agreement to perform a planning report and a preliminary engineering report for the Los Osos/Baywood Park sewerage project. On 23 April 1985, the County Engineer recommended that the Board of Supervisors enter into the agreement which had been negotiated by the County and ES. On April 1985, the Board of Supervisors adopted a resolution

approving the agreement and authorized and directed the chairman of the Board to execute the agreement. A draft report was submitted to the County for review in July 1985. Completion of the report was delayed until April 1986 pending geotechnical investigation of wastewater disposal sites.

PROJECT OBJECTIVES

The objective of the Los Osos/Baywood Park Sewerage Project is to provide a sewage collection, treatment, and disposal system which will perform reliably and which will impose the minimum level of financial burden to users of the system. The purpose of the project is to protect and preserve the quality of groundwater in the Los Osos/Baywood Park area, as mandated by the Regional Board under the authority of the Porter-Cologne Act. In addition, a paramount objective for the project is to maximize recharge of the Los Osos groundwater basin with treated effluent from the project wastewater treatment facilities.

SCOPE OF WORK

The agreement between the County and ES provides that ES perform two separate phases of work: Phase I Planning Study and Report and Phase II Preliminary Engineering and Basis of Design Report. This report embodies the work performed as part of the Phase I Planning Study.

The purpose of Phase I is to identify the most cost-effective and technically feasible method of collecting and treating sewage and disposing of effluent and sludge in a manner acceptable to the Regional Board. Concepts to be studied and evaluated include the the following:

<u>Sewage Collection System</u>

- Conventional gravity sewers
- Variable - grade gravity sewers
- Pressure sewers
- Combinations of the above

TABLE 8.3

PRELIMINARY CONSTRUCTION COST ESTIMATE FOR INFILTRATION BASINS

Item	Unit	Estimated Quantities	Unit Cost ($)	Estimated[a] Cost ($)
A. Earthwork				
Excavation	CY	54,600	3.50	191,100
Fill	CY	40,900	3.50	143,200
Removal	CY	13,700	2.00	27,400
B. Flexible Liner w/ Anchor	SF	151,00	1.50	226,500
C. Fence	LF	4,800	13.50	64,800
D. Gravel Road	SF	243,500	1.50	365,200
E. Main Feed Lines				
15" Ø pipe	LF	3,650	40.00	106,000
12" Ø pipe	LF	1,300	35.00	45,500
F. Fixed Basin Distribution Piping				
8" Ø pipe	LF	960	30.00	28,800
8" Ø flow meter	ea	24	1,000.00	24,000
8" Ø gate valve	ea	24	800.00	19,200
G. Movable Irrigation Piping				
8" Ø (aluminum)	LF	3,600	10.00	36,000
Total				1,278,000
Contingency @ 20%				256,000
Subtotal				1,534,000
Overhead and profit @ 15%				230,000
Total estimated construction cost				1,764,000

[a]ENR CCI 5180.

Land Requirements

Actual land requirements will depend on which quadrant in site 6 is selected and how much buffer zone is required. As stated above, Quadrant II was selected and it is assumed that a 200-foot buffer to the north between the lots south of Highland Drive and the basins will be

upper aquifer (and potential indirect recharge of the lower aquifer) is now planned via a combination of discharge to Los Osos Creek during dry weather and to percolation ponds during wet weather. Discharge to Los Osos Creek may result in direct recharge of the lower aquifer zone. The percolation ponds will be located at Site 6 south of Los Osos and near Broderson Road near the southern and upper edge of the upper aquifer zone (see Figure 5.1 for Site 6 location).

Chapter 6 - Development and Evaluation of Alternative Collection Systems

The capital cost of the sewage collection system for the project represents roughly 80 percent of the initial cost estimate for the total project. Alternative collection systems have been evaluated to determine if use of these systems in lieu of the conventional gravity sewer system originally proposed for the project can substantially reduce the cost of the sewer system, and thus the cost of the overall project.

Five types of sewage collection systems were evaluated. The first was a conventional gravity sewer system, which was used to set comparison standards of cost and performance. The alternative sewer system types which were evaluated consisted of pressure sewers with STEP pumps, pressure sewers with grinder pumps, and variable grade gravity sewers.

In general, the capital costs of alternative systems are lower than for a conventional gravity sewer system but O&M costs of alternative systems are much higher than conventional systems. Alternative systems typically have additional nuisances not usually associated with conventional systems such as potential for unforeseeable maintenance costs, septic tank maintenance, pump systems located in users' yards, odors from vented lines containing septic tank effluent, and so forth. In the appropriate situation, however, the cost savings from the use of alternative systems has been found in some instances to outweigh any associated uncertainties and nuisances.

Based on an initial evaluation, conceptual level designs were prepared for the conventional system, several alternative pressure sewer systems with STEP pump units, and a combination system of conventional gravity sewers and pressure sewers. Although STEP pump units require a septic tank, they were selected over grinder pumps due to lower capital

SUPERIOR COURT OF CALIFORNIA

COUNTY OF SAN LUIS OBISPO

PROHIBITION ZONE LEGAL DEFENSE FUND aka CITIZENS FOR CLEAN WATER; ALAN MARTYN; JACQUELINE MARTYN;; RHIAN GULASSA; JOHN DERGARABEDIAN; JAN DERGARABEDIAN; CINTHEA T. COLEMAN; LAURIE MCCOMBS; ANTOINETTE GRAY PAYNE; BRUCE PAYNE; EDWIN I. INGAN; JUNE Q. INGAN; CLINT KOCH; ANN CALHOUN; CHRISTOPHER ALLEBE; E.E. ALLEBE; CHARLES E. WILKERSON; NORMA WILKERSON; CDO RECIPIENTS #1040; JULIE G. MILLER; LAWRENCE KLEIGER; WILLIAM MOYLAN and BEVERLEY DE WITT-MOYLAN, Petitioners, v. REGIONAL WATER QUALITY CONTROL BOARD, CENTRAL COAST REGION; and DOES 1-50, inclusive, Respondent	Case No.: CV 070472 RULING AND ORDER DENYING PETITION FOR PEREMPTORY WRIT OF MANDATE

I. INTRODUCTION

This case places the Central Coast Regional Water Quality Control Board, a regulatory agency entrusted with protecting local water resources, at odds with approximately 18 families who live in the so-called “Prohibition Zone,” an area of Los Osos where the long-standing use of septic systems has severely contaminated groundwater supplies. The events giving rise to the litigation can be traced to the exploding growth in the Los Osos area during the latter part of the 20th century, and the corresponding, alarming increase in contamination from septic systems.

Efforts by local agencies over the past 25 years to build a sewage treatment plant in Los Osos have until recently come to no avail. Frustrated over local resistance to the treatment plant solution, the Regional Board at some point decided to issue Cease and Desist Orders ("CDOs") to a group of 45 randomly-selected residents who were allegedly using their septic systems in the Prohibition Zone. In a nutshell, the CDOs require selected residents to cease discharging from their septic systems once a treatment plant is finished. In the meantime, these residents must maintain their septic systems by periodic pumping and inspections.

The residents who did not eventually settle their matters with the Regional Board filed suit to invalidate the CDOs on multiple grounds. They argue that the procedures surrounding their CDO hearings violated "due process" requirements and that supporting evidence of individual septic tank pollution was lacking. They urge that the Regional Board misused the administrative process, while attempting to coerce them into signing settlement agreements. They claim that the procedures utilized by the Regional Board were designed to pressure them into voting for an assessment district, to threaten them with criminal prosecution, and to intimidate them with the prospect of losing their homes.

The Court appreciates the mix of emotion, surprise, and helplessness experienced by Petitioners upon receipt of their CDOs. Nonetheless, the evidence belies their legal claims, which the Court finds are exaggerated. Having reviewed the record of the proceedings, the Court does not come away with the notion of a local government agency run amuck. To the contrary, the Court’s overall impression of the hearings is

that the Regional Board went out of its way to provide due process of law, allowing affected residents a reasonable opportunity to speak their minds and to present exculpatory evidence.

Although the Court recognizes that legitimate debate exists whether it has been worth the time, effort, and overall cost (in manpower resources, money, and local community anxiety) to undertake individual enforcement actions against select residents of the Los Osos community, the Court concludes that the actions of the Regional Board did not violate due process. Further, the CDOs issued by the Regional Board are supported by substantial evidence, and they are not otherwise deficient.

II. STATEMENT OF FACTS AND PROCEDURAL HISTORY

The coastal communities of Los Osos and Baywood Park are located just south of the City of Morro Bay. Between 1950 and 1980, the population increased dramatically, leading to several problems, including commensurate levels of wastewater being discharge from private septic systems. Over time, the shallow Los Osos groundwater quality has become increasingly degraded due to rising effluent discharges from individual on-site wastewater disposal systems. Multiple reports and studies have identified and quantified the increasing seriousness of this problem, amounting to a legitimate public health hazard. Administrative Record ("AR") 000439 and 000447.[1]

Among other things, studies have shown "a high incidence of occurrence of infantile [disease] in communities utilizing drinking water supplies with excess nitrate concentrations. AR000376. Sewage effluent contributes approximately 91% of the nitrogen to groundwater. In other words, sewage effluent contributes at least 707,000 pounds per year of nitrates. AR 000451. Further, many studies document the potential public health threat due to the high groundwater table, which causes septic system failures and surfacing of effluent. AR 000452.

[1] The approximately 14,000-page AR has been supplied by the Regional Board on DVDs for the Court and the parties.

Water supply within the Los Osos basin is entirely from groundwater, being supplied by municipal and private water companies. Groundwater degradation has been detected in the upper reaches of this basin. Over time, more degradation and contamination is likely to occur in the lower groundwater due to mixing with the upper groundwater.

In 1983, recognizing these ongoing public health concerns, as well as the threat of increasing environmental contamination, the Regional Board adopted Resolution 83-13, which will be discussed more fully herein. This Resolution includes findings stating that Los Osos/ Baywood Park area has high soil permeability and high groundwater. It states that the majority of lots are too small to provide adequate dispersion of individual sewage disposal system effluent, that the groundwater is seriously polluted with excessive nitrate concentrations (in violation of drinking water standards) and bacterial analyses showing very high total coliform levels (in violation of state drinking water standards). AR 006357.

As late as 1995, an engineering firm concluded that individual septic systems appear to be the major contributor of nitrate to shallow groundwater. AR 006361. In June 2006, expert hydrologists detected the presence of pharmaceuticals, an anti-seizure drug, antibiotics, as well as drugs used in shampoo and other toiletries, in all wells sampled in the shallow aquifer.

These chemicals are found only in human waste water sources. They do not occur naturally and are not used in agriculture. They are highly soluble in water and do not have a tendency to bind in soil. Their presence indicates that septic system contamination is expanding into groundwater sources with a variety of unknown chemicals causing unknown impacts. AR 006363.

Proposals to mitigate the groundwork contamination/public health problem in the Los Osos/Baywood Park area have, until recently, faced insurmountable political hurdles and large-scale community resistance. Although the reasons for these long-running difficulties are beyond the scope of this writ proceeding, suffice it to say that, at some point in 2006, the Regional Board began to contemplate individual enforcement actions against people owning homes or living in the Prohibition Zone.

The Regional Board eventually sent notices to 45 individuals stating that they were being considered for enforcement action as a consequence of their violating the discharge prohibition contained in Resolution 83-13. AR 6023-6026. Following administrative hearings, the issuance of cease and desist orders, and an unsuccessful appeal to the State Water Board by Petitioners, this writ proceeding followed.

On September 3 and 28, 2010, after several rounds of briefing, motions to augment the administrative record and other procedural scuffles, the writ hearing took place. Although a writ hearing typically resembles a civil law and motion hearing, and although oral argument is usually short, sometimes as brief as a few minutes and rarely lasting as long as an hour (*California Administrative Mandamus* CEB 3d ed. §14.1, p. 523), the Court set no time limits. In the end, it received almost four hours of oral argument from Petitioners' counsel alone, in order to ensure that Petitioners had ample opportunity to present her case. Following a total of nearly five hours of oral argument, the matter was taken under submission.

III. DISCUSSION OF LEGAL ISSUES

In order to prove its case against each of the named Los Osos residents, the Regional Board drew upon Resolution 83-13, and also relied upon circumstantial evidence showing that each of the named residents was utilizing a septic system at their home and was therefore violating the "discharge prohibition" established by the Regional Board in 1983 through Resolution 83-13. Although Petitioners raise an assortment of subsidiary issues, the central questions presented are whether the CDOs issued to each resident are supported by substantial evidence, and whether the hearings, collectively as well as individually, complied with fundamental due process.

A. The Board's CDOs Are Supported by Substantial Evidence

In discussing the validity of the administrative orders at issue here, the Court's review is generally limited to determining whether the Regional Board's adoption of the issuance of each CDO was "arbitrary, capricious, entirely lacking in evidentiary support, or unlawfully or procedurally unfair." *See Sherwin-Williams Co.* v. *South Coast Air Quality Management District* (2001) 86 Cal.App.4th 1258, 1267. This determination, in turn, is ordinarily limited to a review of the evidence found in the

administrative record. If such evidence supports the Regional Board's findings, the decisions should be affirmed. *See East Bay Mun. Utility Dist.* v. *Dept. of Forestry* (1996) 43 Cal.App.4th 1113, 1122-1112; *Western States Petroleum Assn.* v. *Superior Court* (1995) 9 Cal.4th 559, 564 and 573 fn. 4.[2]

Water Code section 13301 requires a "notice and hearing" prior to issuance of a cease-and-desist order. The record demonstrates that, after providing notice, the Regional Board followed the adjudicative procedures set forth under Chapter 4.5 of the APA (Gov. Code, § 11400, et seq.) and the regulations set forth at Cal. Code Regs., Title 23, § 648, et seq. *See* Government Code section 11425.10, subdivision (a)(1) (administrative agency must provide parties with "notice and an opportunity to be heard, including the opportunity to present and rebut evidence.")

Within this general framework, the Regional Board may conduct adjudicative proceedings "in a manner as the Board deems most suitable to the particular case with a view towards securing relevant information expeditiously without unnecessary delay and expense to the parties and to the Board. *See* Cal. Code Regs., tit. 23, § 648.5(a).

In the case of the contested CDOs, the Regional Board hearing panel framed two fundamental issues that it was being called upon to decide: 1) whether the persons named in the proposed cease-and-desist orders were discharging or threatening to discharge in violation of the basin plan prohibition; and, 2) whether the requirements of the proposed cease-and-desist orders were the appropriate remedies for the violations. AR 011827.

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[2] Evidence found outside the administrative record generally is not admissible to show that an agency acted inappropriately. *Western States Petroleum Assn.* v. *Superior Court* (1995) 9 Cal.4th 559, 564 and 573, fn. 4. This Court has ruled on multiple occasions that Petitioners have not established the elements necessary to augment the AR with extra-record evidence. *See,e.g.*, Respondent's RJN Ex. A, 9:25-12:28 and 11:12-13. Although Petitioners continue to assert that documents were omitted from the record, these arguments were not raised within 10 days of the Court's 2008 Ruling in a timely motion for reconsideration, and cannot be considered. *See* Code Civ. Proc., § 1008, subd. (e). Further, especially without supporting declarations, it is insufficient merely to allude to thousands of vaguely specified documents that appear never to have been considered by or presented to the Regional Board. *See* Exhibits A through D to Petitioners' Request for Judicial Notice in Support of Petition for Writ of Mandate. Moreover, much of the information they seek to include is already contained in the AR. *See* AR 005180, 006534, & 006836. With one exception discussed hereinafter, the continued efforts to augment the AR are ill-conceived.

To decide these questions, the Board allowed each Petitioner the opportunity to present limited oral and documentary evidence, and to cross-examine certain important witnesses.[3] Putting aside the initial hearing, which was somewhat more lengthy, involving evidence that was common to all cases, a typical hearing against an individual discharger lasted approximately 15 minutes or less, involving basic questions concerning the presence of an operating septic system on each property, and whether the individual petitioner owned the property. *See, e.g.*, AR 013070-013071 (hearing from January 22, 2007).

In terms of substantive evidence, at each CDO hearing (and based primarily on written documents applicable to all dischargers that were submitted by the Prosecution Team prior to the individual hearings) the Regional Board relied heavily upon Resolution 83-13, which amended the Los Osos Area Basin Plan to prohibit discharges of waste from sewage disposal systems as of November 1, 1988. Because this Resolution is central to the outcome of the case, some discussion of its history and adoption is appropriate.

The Basin Plan Amendment, which is set forth on page four of Resolution 83-13 (AR 000395), contains an unqualified and absolute prohibition upon discharges of waste. It provides as follows: [4]

> Discharges of waste from individual and community sewage disposal systems are prohibited effective November 1, 1988, in the Los Osos/Baywood Park area, and more particularly described as: "Groundwater Prohibition Zone
> (Legal description to be provided for area prescribed by Regional Board).

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[3] The Regional Board used the procedures set forth at Title 23, California Code of Regulations, Division 3, Chapter 1.5 (commencing with Section 647), rather than Government Code Section 11500, et seq. AR 005054, 006387, & 014272. California Code of Regulations, title 23, section 648(b) specifically *excludes* several portions of the Administrative Procedure Act ("APA"), including certain provisions of Chapter 4.5 and all of Chapter 5 except for Government Code section 11513. (Cal. Code Regs., tit. 23, § 648(c).) These regulations were adopted by the State Board, which is not a party to this Petition for Writ of Mandate. Thus, Petitioners cannot challenge the regulations. *See* April 16, 2008 Notice of Ruling, 2:24-25, attached as Respondent's RJN Ex. B.

4 *See, e.g.* AR 013824 ("The Basin Plan prohibition specifies... [that]…Discharges from individual and community sewage disposal systems are prohibited effective November 1, 1988…"). Each CDO contains this language.

(AR 000395.) Thus, Resolution 83-13 prohibited the discharge of *any and all waste* within the Prohibition Zone effective as of November 1, 1988 (five years after its adoption), including waste from any housing units that existed at the time of, or were constructed after, the adoption of the resolution.[5] When the State Board approved the Regional Board's Basin Plan Amendment by Resolution 84-13, it confirmed that the purpose and effect of Resolution 83-13 was to place an absolute ban on waste discharges into the Prohibition Zone effective November 1, 1988. AR 000560.[6]

The Regional Board's 1983 Staff Report for Resolution 83-13 also contains evidence supporting the establishment of the discharge prohibition for the Prohibition Zone. (AR 000435-000547.) For example, the Staff Report states that:

> Shallow Los Osos groundwater quality has been degrading due to sewage effluent discharges from individual and community on-site wastewater disposal systems. A number of reports and studies have been made to identify and quantify this problem.
> (AR 000439.)
>
> As indicated in the Brown and Caldwell Phase I report, there is evidence of human waste contamination of groundwater in the Los Osos ground water basin…This degradation is due primarily to discharges from on-site wastewater disposal systems and establishes a basis for a prohibition of discharge in the Los Osos/Baywood Park area.

AR 000456.

Elsewhere, Resolution 83-13 contains the following finding by the Regional Board:

> WHEREAS, pursuant to Section 13280 of the California Water Code, the Regional Board finds that discharges of waste from new and existing individual

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5 Resolution 83-13 contains several other related discharge prohibitions, including one directed toward additional housing units, and another related to compliance timelines for the County of San Luis Obispo. (AR 000395.) On January 8, 1988, the Regional Board in fact implemented an immediate discharge prohibition on additional units pursuant to Resolution 83-13. *See* Respondent's RJN Ex. F, at p. 13 ("the County is hereby directed not to approve any new septic systems in the prohibition zone applied for after today's meeting"); Respondent's RJN Ex. G, at p. 3 ("If the Board takes no action, it will allow construction of new systems to continue until November 1, 1988, when the current moratorium would take affect.") *See also* AR 000549 ["Resolution 83-13 allows the addition of 1,150 housing units to the prohibition area until full prohibition commences on November 1, 1988."]

6 *See also* AR 000549 ["Resolution 83-13 allows the addition of 1,150 housing units to the prohibition area until full prohibition commences on November 1, 1988."]

> disposal systems which utilize subsurface disposal in the affected area will result in violation of water quality objectives; will impair beneficial uses of water; will cause pollution, nuisance, or contamination; and will unreasonably degrade the quality of waters of the state.

AR 000394 (Resolution 83-13).

The Staff Report, in turn, refers to and relies upon studies and reports from Brown and Caldwell Consulting Engineers, the Department of Water Resources, the San Luis Obispo County Health Department, and the State Water Resource Control Board. *See* AR 00439; AR 000142-000382. The evidence supporting the Prohibition Zone is summarized in the Prosecution Team's September 8, 2006 Staff Report. AR 006357-006362.

In an administrative proceeding like this one, the burden of proving the charges rests upon the party making them, in this case the Regional Board. *Parker v. City of Fountain Valley* (1981) 127 Cal.App.3d 99, 113. "The obligation of a party to sustain the burden of proof requires the production of evidence for that purpose." *Id.* One of the central points raised by Petitioners during the administrative process was the absence of any *direct* evidence showing the discharge of waste by any individual landowner through their particular septic system. In this regard, the prosecution team conceded that it had not visited any specific CDO sites and that it had collected no site-specific data vis-à-vis any particular property. Petitioners called this "prosecution by implication."

Although the Regional Board did not directly prove, through sampling or test data, that any individual septic system was discharging prohibited "waste," for several reasons such direct evidence was unnecessary. First, there is considerable evidence in the record that septic systems are the primary source of the contamination threatening surface and groundwater areas within the Prohibition Zone. Second, what the prosecution team *did* prove, largely from written and oral admissions by petitioners, was that each individual property was then occupied, and that each property was then operating a septic system to dispose of human waste materials. Third, the prosecution team proved that, even when operated properly, septic systems are a significant source of waste that is discharged to the environment.

The presence of operational septic tanks, a known source of significant pollution within the Prohibition Zone, is therefore relevant evidence (albeit circumstantial evidence) supporting the conclusion that prohibited waste discharges were occurring. Contrary to petitioners' argument, relevant circumstantial evidence is admissible in California administrative proceedings. *Jackson v. Department of Motor Vehicles* (1994) 22 Cal.App.4th 730, 741 (circumstantial evidence may properly be admitted to establish liability in administrative proceedings). *See Hasson v. Ford Motor Co.* (1977) 19 Cal.3d 530, 548; Evid.Code, § 351. Moreover, circumstantial evidence can support a finding of "substantial evidence" in administrative proceedings. *Pereyda v. State Personnel Board* (1971) 15 Cal.App.3d 47, 50; *People v. Goldstein* (1956) 139 Cal.App.2d 146, 155. Indeed, even when contradicted by direct testimony, the finder of fact is entitled to accept persuasive circumstantial evidence to the contrary. *Hasson,* 19 Cal.3d at p. 548; *Norris v. State Personnel Bd.* (1985) 174 Cal.App.3d 393, 398-99.

Based upon the record evidence before it, the Regional Board was entitled to conclude that septic system discharges are illegal in the Prohibition Zone whether or not the systems are operating properly or working as designed. Based upon Resolution 83-13, the supporting studies and staff testimony, sufficient evidence supports the Regional Board's conclusion that a violation was occurring because a particular petitioner resided within the Prohibition Zone discharge area, and that that he or she was utilizing an individual sewage disposal system.[7]

With respect to compliance deadlines, the CDOs contain various options depending upon actions taken by the County of San Luis Obispo directed toward building a community sewage treatment system. Because the County of San Luis Obispo has approved the benefits assessment for a Los Osos community sewer system, the CDOs require Petitioners to "cease all discharges from Septic Systems by *the later of January 1, 2011 or two years following written notice* by the Executive Officer" that

[7] Petitioners claim that the Regional Board "has not revealed how the randomly selected recipients were selected although many requests have been made for that information." (Opening Brief, 30:28.) However, the Regional Board indeed did describe in a staff report how the CDO recipients were selected. *See* AR 006354, at footnote 1.

a "material cessation of the work" on the community sewer system has occurred. *See* AR 013827, at para. 3, italics added. The Executive Officer has not provided such notice. Thus, the CDOs provide *at least* two additional years starting from January 1, 2011, before cessation of discharges could possibly be required.

"All discharges of waste into waters of the state are privileges, not rights." Water Code, § 13263 (g). Given that the Regional Board has prohibited all discharges into the Prohibition Zone since November 1, 1988, the two year CDO compliance schedule (plus the time that has already passed since the CDOs were adopted) is reasonable. Simply stated, our local regulatory officials responsible for the maintenance of public health and welfare do not need to sit helplessly by while recognized, cumulatively-serious sources of pollution remain unregulated and unaddressed.

With respect to enforcement options, the CDOs at issue here require Petitioners periodically to test and pump their septic systems. Such a requirement imposes little more than normal maintenance obligations and cannot be considered onerous. The CDOs impose ***no fines whatsoever***, as Petitioners recognize. *See* Petitioners' Opening Brief, at 10:15-17. Rather, the CDOs provide that "failure to comply with provisions of this order *may subject* the discharger to further enforcement action…" *See* AR 013829 (emphasis added).

Before assessing civil liability, however, the Regional Board would have to hold another series of administrative hearings. Wat. Code, §§ 13350, subd. (e) and 13323. ***If*** such hearings were ever to occur, the Regional Board would have discretion whether to impose penalties (and in what amount). Further, Water Code section 13327 would require the Regional Board to consider such factors as the discharger's degree of culpability, ability to pay, and other matters as justice may require. Of course, no such discretion has yet been exercised, and it would require another series of administrative hearings before the Regional Board would be able to do so. Moreover, ***if*** any administrative civil liability were imposed, it would then be subject to State Board review and Superior Court review. Water Code §§ 13320 & 13330. Contrary to Petitioners' assertions, the CDOs contain a reasonable enforcement methodology that is designed to bring about compliance.

As stated, this Court's review is limited to determining whether there is "substantial evidence" supporting the Regional Board's decisions to issue cease-and-desist orders to Petitioners. *Young v. Gannon* (2002) 97 Cal.App.4th 209, 225 (Substantial evidence means "evidence of ponderable legal significance…reasonable in nature, credible, and of solid value.") A thorough review of the administrative record, together with the video recordings of the enforcement hearings, shows that there is indeed substantial evidence supporting: 1) the establishment of the discharge prohibition; 2) violations of the discharge prohibition by named individuals; and, 3) a reasonable plan for bringing about compliance. That is all the law requires. [8]

B. The Board's CDO Hearings Complied with Due Process

The U.S. and California Supreme Courts have held that, while the form of due process varies "as the particular situation demands," it requires a "reasonable opportunity to be heard." *Gilbert v. Homar* (1976) 520 U.S. 924, 930; *Jonathan Neil & Assoc., Inc. v. Jones* (2004) 33 Cal.4th 917, 936. Given the issues, procedures, compliance deadlines, remedies and evidence discussed above, the Board afforded Petitioners both reasonable notice and a reasonable opportunity to be heard. However, some particular issues raised by petitioners deserve further elaboration.

First, throughout these proceedings, Petitioners' counsel has urged that a review of the video recordings of the enforcement hearings occurring on December 14 and 15, 2006, and January 22 and May 10, 2007, would show evidence resembling a "kangaroo setting." However, the documentary and video evidence does not sustain these assertions.

Despite its earlier ruling that all video recordings would be excluded as extra-record evidence, the Court has, *sua sponte*, reconsidered this ruling. Upon reflection, contemporaneous video recordings are, if not part of the record, certainly admissible

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[8] Although Petitioners claim that the Regional Board lacks authority to issue CDOs to individuals, this is belied by a plain reading of the Water Code, which states that "the board may issue an order to cease and desist and direct that those *persons* not complying with the requirements or discharge prohibitions" comply with them. (Wat. Code, § 13301, italics added.) "'Person' means *any person*, firm, association, organization, partnership, business trust, corporation, limited liability company, or company." (Wat. Code, § 19, italics added.)

extra-record evidence for several purposes relevant to this proceeding. *See Western* States, 9 Cal.4th at 580 fn. 5 (court may admit extra-record evidence relevant to the accuracy of the administrative record, procedural unfairness, and agency misconduct); s*ee* Kostka & Zischke, Practice Under the Cal. Environmental Quality Act, § 23.55, pp. 967-968.

Petitioners allege that the record is incomplete and that the Regional Board denied them due process of law. Video recordings of the actual proceedings certainly provide, at the very least, a confirmation of what evidence was considered and how the hearings were conducted, as well as important demeanor evidence giving significant context to the hearing process. *Western* States, 9 Cal.4th at 580 fn. 5.

What the videos demonstrate to the Court is that the hearings were conducted by the Regional Board with dignity, civility and forbearance. In what was occasionally a rude and sometimes hostile audience, Regional Board members repeatedly assured recipients of CDOs that all they had to do was to periodically pump and inspect their septic tanks until a community-wide solution was realized.

To claim, as petitioners do, that they were subjected to the "full weight of the regulations for performing an essential activity, using the toilet, without recourse, believing that they could lose their homes" mischaracterizes what transpired. Even after a brief consultation with counsel (many of whom it appears were available to residents on an ongoing basis during the administrative proceedings), it should have become clear that the likely consequences of an adverse enforcement order were far less onerous than the loss of a home or criminal prosecution.

Chairman Young in particular did his best to assure procedural fairness, and to require both sides to abide by the established procedures. Throughout, he demonstrated extraordinary patience and skill as the lead hearing officer. In short, the video recordings show the citizens' government at work; they do not show an abuse of power or procedural irregularities.

Second, Petitioners claim that it was unreasonable, and violative of due process, to be confined to 15 minutes apiece for their individual presentations. Once again,

however, the video recordings belie any procedural unfairness with respect to time limits. In addition to allowing petitioner's 15 minutes for their own presentation, Petitioners were afforded additional time to present "common evidence and testimony" at the beginning of the hearing process, and they were given additional time (15 minutes) to cross-examine the prosecution team witnesses. Yet Petitioners devoted much of their time to "political" issues (e.g., support for a regional treatment system, or whether it made sense to issue CDOs to individual dischargers) rather than issues focusing on liability for site-specific septic waste discharges.

The Regional Board was allowed under its governing rules and regulations to craft a common sense approach in terms of how it conducted the CDO hearings. To do so, it established the order of presentation of evidence, took all testimony under oath, and, as stated, allowed cross-examination of witnesses. (AR 006382-006388.) It complied with the requirements of Government Code section 11425.10, subdivision (a)(1) and Cal. Code Regs., tit. 23, § 648.5(a). It allowed parties to submit written argument before the hearings (AR 006384-006386), and allowed them to incorporate the written testimony of others by reference. The record confirms that Petitioners took full advantage of this option. *See, e.g.,* AR Index 005057-005469. The procedures adopted do not violate due process of law.

Third, Petitioners claim that the proceedings were irreparably "tainted" by the participation of Prosecution Team counsel Lori Okun. *See Morongo Band of Mission Indians v. State Water Resources Control Board* (2009) 45 Cal.4th 731 and *Quintero v. City of Santa Ana* (2003) 114 Cal.App.4th 810. In *Morongo*, however, the Supreme Court rejected the rationale that Regional Board members will automatically give greater weight to the prosecuting attorney's "arguments by virtue of the fact she also acted as their legal adviser, albeit in an unrelated matter." (*Id*., at p. 741.) Instead, the Court held that:

> the presumption of impartiality can be overcome only by specific evidence is demonstrating actual bias or a particular combination of circumstances creating an unacceptable risk of bias.

(*Id*.)[9]

Petitioners have made no such showing in this case. To the contrary, the Regional Board separated its prosecutorial functions from its adjudicative functions, and it prohibited ex parte contacts during the CDO proceedings. Gov. Code, §§ 11425.10, subd. (a)(4) & 11430.10 et seq.; see also Regional Board's January 18, 2006 Memorandum at AR 005008-005010. There is no evidence, in the record or elsewhere, that the Regional Board violated these rules of conduct.

There is an additional problem with petitioners' arguments concerning "taint." Ms. Okin recused herself early in the proceedings, and the prosecution began its case anew. AR 006112-006114; 006348; 006349-006379; 011605, 011912, & 013046. The appropriate remedy for a "tainted" hearing is a new hearing, which was granted by the Regional Board in an abundance of caution. *See Quintero*, at p. 818 ("ordering a new hearing"); *Kumar v. National Medical Enterprises, Inc.* (1990) 218 Cal.App.3d 1050, 1056 (unfair hearing "requires a remand for further proceedings") [10]

Fourth, Petitioners claim that the "unavailability of [Regional Board Executive Officer] Roger Briggs to testify or to be cross-examined during the hearings when CDOs issued, renders the orders invalid." Petitioners' Opening Brief, 25:20-21. In support of this claim, Petitioners cite *Manufactured Home Communities, Inc. v. County of San Luis Obispo* (2008) 167 Cal.App.4th 705. However, the Court held in *Manufactured Home Communities* that, "where a board makes a decision based on a party's testimony, the adversary is entitled to question his or her opponent." 167 Cal. App. 4th at 712. Here, it does not appear that Executive Officer Briggs provided significant testimony upon which the Regional Board relied. Moreover, several Petitioners were afforded the opportunity to take the deposition of Briggs and

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[9] The Supreme Court in *Morongo* disapproved of *Quintero's* suggestion of "the existence of a per se rule barring agency attorneys from simultaneously exercising advisory and prosecutorial functions, even in unrelated proceedings." *Morongo*, at p. 740, fn 2.

[10] Although Petitioners contend that the Regional Board improperly entered into settlement agreements, referred to as "clean-up and abatement orders" or "CAOs," (See, e.g., Opening Brief, 1:11, 11:25, & 27:17-21), Petitioners have "no standing to challenge the validity of settlements entered into by parties who are strangers to this lawsuit" and that "at this juncture, the petitioners have not established standing to challenge the validity of settlement agreements where the petitioners are not a party." (See Respondent's RJN Ex. A, 9:2-10.) None of these Petitioners received a CAO, nor do they claim to have.

Petitioners have not shown how his absence reasonably could have prejudiced the proceedings.[11]

C. Miscellaneous Contentions

Petitioners argue that the Regional Board showed leniency toward the Prosecution Team, and bias against Petitioners. Although they allege that the Regional Board refused to grant Petitioners' requests for continuances, the record shows that Petitioners were granted continuances on at least three occasions. *See* AR 005051, 006399, & 013179.

Petitioners also claim that the Regional Board failed to consider all of their evidence, and refused to take into account Petitioners' objections (Petitioners' Opening Brief, 30:14-19), offering three specific examples. First, Petitioners claim that the Regional Board excluded "as many as 600 of the 847 documents" presented by Petitioners, but allowed "every single document submitted by the Prosecution Team." *See* Petitioners' Opening Brief, 30:9-13. However, in its December 8, 2006 Order, the Regional Board explained in detail the basis of its ruling on each of the 847 documents. AR 011544-011547. Petitioners have not addressed the propriety of any particular ruling, or explained how such a ruling might have adversely affected their interests. It is difficult for the Court to attribute much credence to such a generalized objection.

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[11] There is an additional significant barrier to many of the claims raised in this Court. Before seeking judicial review, a party must exhaust its administrative remedies by petitioning the State Water Resources Control Board ("State Board") for review of the claims the party made against the Regional Board. Water Code, § 13320; *Hampson v. Superior Court* (1977) 67 Cal.App.3d 472, 484-485 (failure to seek timely State Board review constitutes failure to exhaust administrative remedies.) A party's failure to do so precludes any judicial attack on the challenged conduct. *Metcalf v. County of Los Angeles* (1994) 24 Cal.2d 267, 269; *Tahoe Vista Concerned Citizens v. County of Placer* (2000) 81 Cal.App.4th 577, 589. Petitioners seek judicial review of several issues they did not raise to the Regional Board before the CDOs were adopted and/or did not raise in their administrative petitions to the State Board under Water Code section 13320. Petitioners claim that the Regional Board violated: (a) Government Code section 11400-11529 and California Code of Regulations, title 23, section 647-648.8, et seq., and 649.6 (Opening Brief, 11:24-12:13); (b) the Bagley-Keene Act codified as Government Code section 11121.5 et seq. (Opening Brief, 7:23-24); and (c) Water Code section 13241 (Opening Brief, 23:10-11). However, Petitioners' administrative petitions to the State Board do not contain these allegations. (AR 013482-013498 [Various petitioners], AR 013839-013852 [the Wilkersons], & AR 013905-013913 [William Moylan & Beverley DeWitt-Moylan].) Thus, these claims are barred.

Second, Petitioners argue that "on April 9, 2007, the RWQCB issued a Protective Order prohibiting further discovery." Petitioners' Opening Brief, 30:12-14. However, the record shows that the Protective Order was issued in order to stop Petitioners from issuing or requesting belated deposition subpoenas of Regional Board staff. The Regional Board concluded that Petitioners had attempted "to use inappropriate demands for discovery to obstruct Central Coast Board proceedings in this matter." AR 013629-013631. Moreover, the deadline for the submission of written evidence was November 15, 2006, and the evidentiary hearings took place on December 14 and 15, 2006, and January 22, 2007, long before Petitioners' tardy discovery efforts. The Regional Board did not act improperly in this regard. [12]

Third, Petitioners' challenge the validity of Resolution 83-13, which was referenced on multiple occasions during the CDO hearings, and which served as important evidence for the prosecution team. *See* AR 006377 & 014287 (Doc. Num. 1, Submitted by Prosecution Staff, "*Water Quality Control Plan, Central Coast Basin*, including Resolution 83-13"); *see also* Respondent's RJN Ex. I, at p. 3-11. The Court has already addressed the evidentiary importance of Resolution 83-13. With respect to a facial challenge, however, this Resolution was adopted 25 years ago. It is far too late now to bring a facial challenge to the legality of this Resolution. *See* Respondent's RJN Ex. B, 2:22-23.

Fourth, Petitioners have provided scant support for their Public Records Act cause of action. Ordinarily, the Court is not even required to consider points not supported by citation to authorities or the record. *Kim v. Sumitomo* (1993) 17 Cal.App.4th 974, 979. In any event, the Regional Board complied with all applicable Public Records Act requirements. See Gov. Code, §§ 6250 et seq.; AR 014312-014344. The Regional Board responded to Petitioners' requests by informing them that the requested documents were available at the Regional Board (e.g., AR 014317), by requesting

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[12] The Regional Board adopted the last two CDOs on May 10, 2007, during a meeting that considered the subpanel hearing held on January 22, 2007. (AR 013806.)

clarification of ambiguous requests (e.g., AR 014343), or by determining that the requested documents were privileged (e.g., AR 014340). Further, many of the requested documents were exempt from disclosure under various provisions of the Government Code. See, *e.g.*, Gov. Code, § 6254(k). The Regional Board's responses contain the full list of applicable privileges.

Fifth, Petitioners claim that continued CDO enforcement is contrary to the intent of Assembly Bill 2701, as codified in Government Code section 25825.5. Petitioners' Opening Brief, 13:5-14:8. However, this Court previously struck from the Petition all allegations relating to AB 2701, ruling that "Government Code §25825.5 has no impact on the Regional Board." *See* Respondent's RJN Ex. A, at 9:12-13.)

Finally, it must be said that the Court has attempted to address each of the important issues raised by Petitioners. Given the exhaustive list presented, it simply has not been possible to discuss each and every concern. Suffice it to say that all of Petitioners' other contentions have been considered and determined to lack merit sufficient to overturn the CDOs.

IV. CONCLUSION

This lawsuit is not the proper forum in which to debate whether, in the final analysis, it has been worthwhile bringing enforcement actions against individual residents of Los Osos. However, having reviewed the administrative record, as well as all relevant, admissible extra-record evidence, the Court concludes that the Cease and Desist Orders issued by the Regional Board are supported by substantial evidence, and that the hearings were conducted in the manner required by law. Accordingly, the petition for a peremptory writ of mandate is DENIED. It is so ORDERED. Counsel for respondents shall prepare the Judgment.

DATED: December 28, 2010

_____\s_____
CHARLES S. CRANDALL
Judge of the Superior Court

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Los Osos Wastewater Project
Environmental Report

Two Discs Included: Draft EIR (11/14/2008) and Final EIR (3/30/2009)

Prepared for:

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April 2010

Storm Water Associated with Construction Activity (Construction General Permit 99-08-DWQ). Construction projects of greater than 1 acre require a National Pollutant Discharge Elimination System permit. This permit will require the preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP) for the LOWWP, and would serve to further minimize the chance of a substantial decrease in water quality as a result of construction activities. Construction activities must also comply with the stormwater control requirements outlined in a project specific Sedimentation and Erosion Control Plan, and must adhere to general guidelines outlined in the SWMP.

During construction of this system, BMPs would be implemented as required by the SWPPP and the Sedimentation and Erosion Control Plan to control storm water quality. To address runoff and erosion during and after construction, the Sedimentation and Erosion Control Plan includes the following measures:

- Incorporation of onsite runoff collection systems which includes energy dissipation, berms, temporary settling basins, and/or a silt/hydrocarbon separator for the collection and removal of hazardous materials and sediments.
- Incorporation of onsite drainage systems to collect runoff from all impervious onsite surfaces, including parking spaces, roads, and buildings. Discharges of greater than five feet per second may be attenuated for by being released through an energy dissipater or outlet.
- Collection of surface runoff at curbs, gutters, and drainage swales will be conveyed to an appropriate point of disposal.
- Possible incorporation of sub-surface drains to intercept seepage and convey it to an acceptable point of disposal.
- Revegetating portions of the site exclusive of paved areas as soon as reasonable after grading.
- Incorporating rain gutters and downspouts for buildings.
- Grading surfaces adjacent to buildings so that runoff is conveyed away from foundations and onto paved surfaces or underground collection pipes.

3.6.2.3 Impacts to Existing Water Supply

The annual groundwater outflow from the Los Osos area will be reduced by the LOWWP. Septic tanks in the wastewater service area currently discharge 1,237 acre feet of septage to the shallow groundwater annually. This represents approximately 28% of the flow into the groundwater under the service area. However, because it is discharged near the surface, approximately 90% of the septage flows out of the groundwater system and into Morro Bay and the ocean. Therefore, the current method of wastewater treatment and disposal results in the annual loss of 1,113 acre feet of groundwater. The LOWWP will collect the wastewater and return the recycled water to the groundwater system through the Broderson and Bayridge leachfields, and through replacing groundwater pumped for irrigation. Together with the water conservation program, the LOWWP reduces the annual groundwater outflow lost as a result of wastewater treatment to 339 acre feet (the volume of discharges at Broderson and Bayridge that does not percolate to the lower aquifers). This results in a net annual

3.12.2 Cumulative Effects on the Physical Environment

Air Quality

Cumulative effects to air quality would result primarily from construction vehicle exhaust and fugitive dust emissions during site preparation and construction activities. These temporary increases in NO_X, PM_{10}, and CO during construction would be cumulative with similar emissions from nearby construction projects and permanent facility operations; however with the mitigation incorporated into the project, cumulative emissions are expected to be less than substantial.

Groundwater and Water Quality

Overall beneficial effects to groundwater and water quality are expected as a result of project implementation. Wastewater would no longer leach from the existing septic systems into the Los Osos groundwater basin. Additionally, recycled wastewater will be reused within the community or surrounding agricultural land overlying the groundwater basin. It will either be discharged through leach fields or directly reused for urban or agricultural irrigation.

Recycled water will be returned directly to the upper aquifer at two leach field sites: the Broderson property and at the existing Bayridge leach field. The existing septic tanks in the Bayridge neighborhood would be abandoned or repurposed to collect rainwater and the leach field would be used for recycled water reuse instead of septic tank leachate. In addition, the Project includes a suite of reuse options aimed at optimizing sea water intrusion mitigation. These reuse options include agriculture and urban re-use, as well as environmental reservations to handle the remainder of the recycled water depending on the season. Because of its key role in reducing seawater intrusion, the Broderson leach field is the primary recycled water reuse element. This treated recycled water flow projection also assumes that the County implements water conservation measures (refer to Section 3.6.2.3).

The annual groundwater outflow from the Los Osos area will be reduced by the LOWWP. Septic tanks in the wastewater service area currently discharge 1,237 acre feet of septage to the shallow groundwater annually. This represents approximately 28% of the flow into the groundwater under the service area. However, because it is discharged near the surface, approximately 90% of the septage flows out of the groundwater system and into Morro Bay and the ocean. Therefore, the current method of wastewater treatment and disposal results in the annual loss of 1,113 acre feet of groundwater. The LOWWP will collect the wastewater and return the recycled water to the groundwater system through the Broderson and Bayridge leach fields, and through replacing groundwater pumped for irrigation. Together with the water conservation program, the LOWWP reduces the annual groundwater outflow lost as a result of wastewater treatment to 339 acre feet (the volume of discharges at Broderson and Bayridge that does not percolate to the lower aquifers). This results in a net annual benefit of 774 acre feet to the existing water supply. The 339 acre feet “lost” to the groundwater system will serve to maintain near surface water levels in wetlands located at the Bay front, mitigating any related biological impacts from collecting the septage in a centralized treatment system. Consequently, the Project’s effects on groundwater, water quality, and water supply are overwhelmingly beneficial.

Draft EIR
County of San Luis Obispo
Los Osos Wastewater Project

State Clearinghouse No. 2007121034

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November 14, 2008

final proposed project's potential environmental impacts and public comments before completing and certifying the Final EIR.

3.1.2 - Project Goals and Objectives

The primary goal of the LOWWP is to construct and operate a community wastewater collection, treatment and disposal system and, thereby, comply with the RWQCB's WDR Resolution 83-13. Eliminating discharges from onsite wastewater, as directed by the RWQCB, will also help accomplish the LOWWP's second primary goal: alleviating groundwater contamination, primarily nitrates, that has occurred at least partially because of the use of septic systems throughout the community.

One of the wastewater project's secondary objectives involves water resources issues. Water resources issues are important because of seawater intrusion that is contaminating the Los Osos groundwater basin. On March 27, 2007, the County Board of Supervisors certified a "evel of Severity (LOS) III for the community of Los Osos while adopting a Resource Capacity Study of the Los Osos groundwater basin. The LOS III determination is the highest determination of a resource problem under the County's Resource Management System. The wastewater project can be an important first step to solving water resource problems. While the primary purpose of the Los Osos Wastewater Project is to construct a community wastewater system and, thereby, to alleviate groundwater contamination, how that goal is met can create or hinder opportunities for the water purveyors to improve the local water resources.

To summarize, the specific objectives of the Los Osos Wastewater Project are:

- **RWQCB Waste Discharge Requirements.** Address the issues of water quality defined by the Waste Discharge Requirements (WDR) for discharge limits issued by the RWQCB.
- **Groundwater Quality.** Alleviate groundwater contamination—primarily nitrates—that has occurred at least partially because of the use of septic systems throughout the community.
- **Secondary Objectives**
    a) **Water Resources.** Address water resource issues by mitigating the project's impacts on water supply and saltwater intrusion. Further, the wastewater project will maintain the widest possible options for beneficial reuse of treated effluent.
    b) **Environmental Impacts.** Incorporate measures to minimize potential environmental impacts on the Los Osos community and surrounding areas, (including, but not limited to, habitat conservation, endangered species and habitat, air and water quality, greenhouse gas emissions, social and economic sustainability, wetlands and estuary preservation or enhancement, cultural resources protection, and agricultural land enhancements).
    c) **Project Costs.** Meet the project water quality requirements while minimizing life-cycle costs and the related affordability impacts to residents.
    d) **Regulatory Compliance.** Comply with applicable local, State, and federal permits, land uses, and other requirements including the Local Coastal Plan, Environmentally

prepared by the County's engineering consultant. The public had an opportunity during the TAC public meetings to ask questions and comment on the LOWWP progress.

The election that approved the Proposition 218 assessment district demonstrated community support for the LOWWP. The community survey will provide another opportunity to consider community preferences for the LOWWP. The survey will be based on the preliminary engineering analysis, Draft EIR, and a Public Works Project Memo describing the current LOWWP project status and plans for the final design, permitting and Design/Build process.

7.3 - Project Alternatives

This section briefly describes and compares the feasibility and environmental impacts of alternative project components for the LOWWP. More detailed descriptions of the Level A alternatives appear in Section 3, Project Description and Appendix B, Project Description Data by Kennedy/Jenks Consultants. For additional detail describing and comparing the Level A, B and C alternatives, refer to Appendix P, Alternatives Information, the Fine Screening Report (Carollo Engineers 2007b) and the Rough Screening Report (Carollo Engineers 2007a). Carollo Engineers and Kennedy/Jenks Consultants have provided further details in the various Technical Memoranda (TMs) on particular project components.

7.3.1 - No Project/No Action Alternative

The No Project/No Action alternative would maintain existing conditions, which involve septic systems and onsite leachfields for most of the Los Osos Community. The negative effects from the continued discharge of septic effluent to area groundwater resources have been well documented, including continued nitrate discharge to the upper groundwater aquifer, continued salt-water intrusion, and a continuing decline in potable water quality. Since the community derives all of its domestic water supply from groundwater resources, continued degradation is considered a significant unavoidable impact associated with the No Project/No Action Alternative. Additionally, the No Project//No Action Alternative would not achieve the basic objectives of the proposed project and would result in noncompliance with the legally binding RWQCB Cease and Desist Order No. 83-13. (Crawford, Multari and Clark Associates, 2001) With the possibility of RWQCB enforcement action against the Los Osos community if existing conditions are maintained, the "No Project" alternative was designated a Level C alternative and dropped from consideration as a non-viable option.

If the County implements the No Project/No Action Alternative, the proposed LOWWP wastewater treatment plant, collection and conveyance system, effluent disposal system and biosolids handling facilities would not be constructed and operated. Therefore, the LOWWP would not cause impacts to the project area during the construction or operation phases. Potentially significant impacts related to the permanent losses of habitat for endangered species and Prime Farmland, geologic hazards, public health and safety, traffic and circulation, construction noise, air quality, groundwater resources, visual resources, and cultural resources would not occur. Actions to mitigate these potentially significant

impacts to a level that is less than significant would not be required. The impacts to prime farmland that cannot be mitigated and, therefore, are significant and unavoidable, would not occur.

7.3.2 - Raw Wastewater Collection System

Collection System Alternatives

Alternatives to collect the raw wastewater from the individual residences and buildings include: gravity, STEP, STEG, combined STEP/STEG, Low Pressure or vacuum collection systems. After the brief project descriptions provided below, the various alternatives are compared and designated as Level A, B or C alternatives.

Gravity Collection System

Gravity collection systems are the most common wastewater collection systems. These systems utilize gravity to transport wastewater to final treatment facilities and/or pump stations. They consist of gravity sewer lines with a minimum diameter of 6- or 8-inches and manholes at change of grade or direction, or at intervals of approximately 350 feet. Gravity collection systems convey both solids and liquids. A conventional gravity system requires pump stations to move sewage from low lying areas to a treatment plant site. The gravity collection system proposed for the LOWWP may also include a low pressure collection system in subareas with high groundwater and difficult excavation conditions.

Septic Tank Effluent Pumping System (STEP)

STEP systems convey septic tank effluent (STE) only; they do not convey solids. They utilize septic tanks at individual service connections to retain the solids. STEP systems use pumps at each septic tank to pressurize the collection system and convey the STE to a main pump station or treatment facility. The collector lines are small diameter (2- to 4-inch) that can be located closer to the ground surface and feed into larger interceptors. At least every five years, septage haulers will pump out the accumulated septage in each septic tank and haul the septage to the wastewater treatment plant.

Septic Tank Effluent Gravity System (STEG)

STEG systems are similar to STEP systems, but do not have individual pumps at each septic tank; conveyance is by gravity. However, since solids remain in the septic tanks, pipe diameters are smaller than for gravity systems and manholes are not used in the system. At least every five years, septage haulers will pump out the accumulated septage in each septic tank and haul the septage to the wastewater treatment plant.

STEP/STEG Collection System

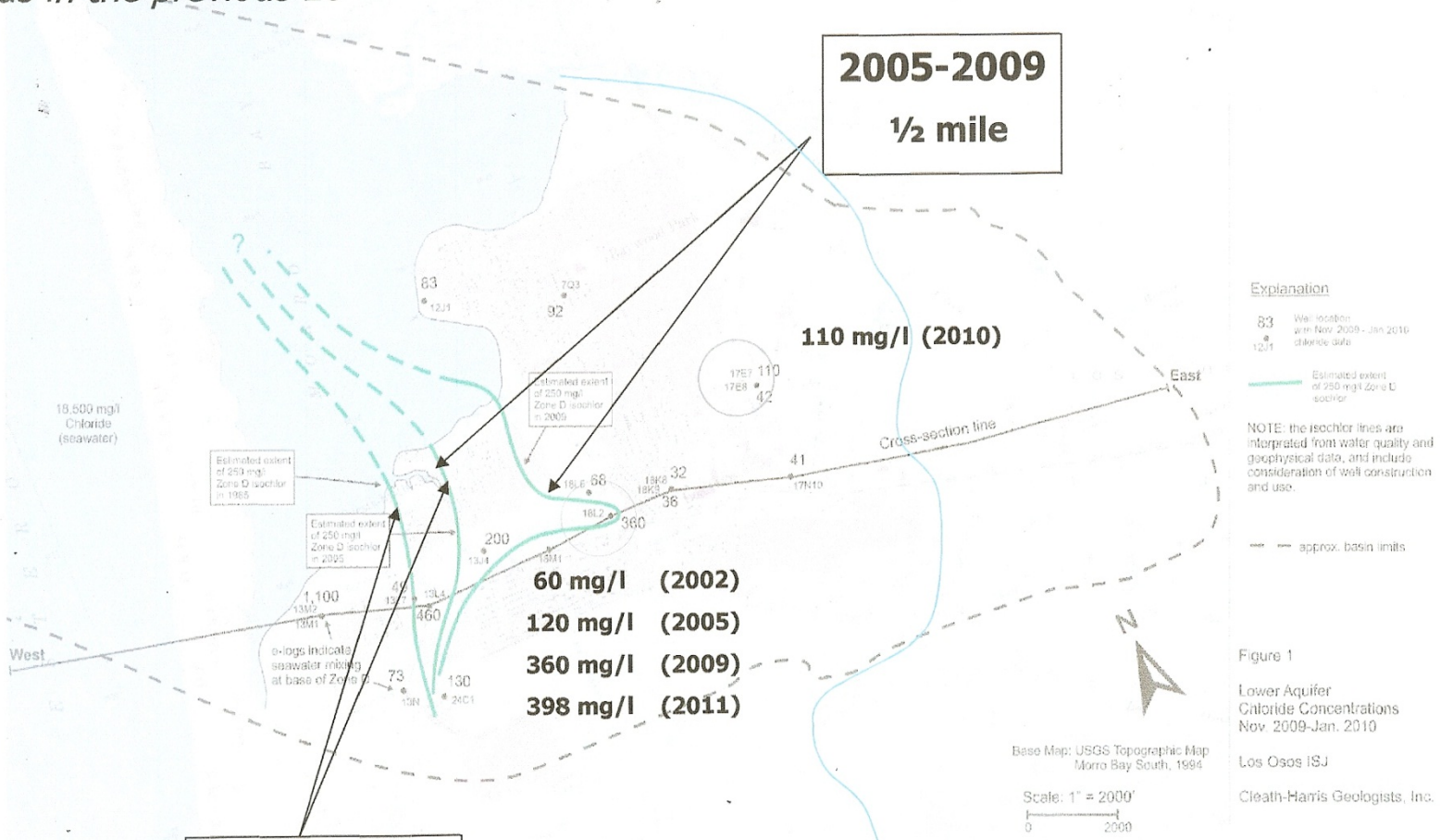
A combined STEP/STEG collection system is one of the alternatives proposed for the LOWWP. It has a combination of STEP systems that have individual pumps at each septic tank and STEG systems that flow by gravity from some of the septic tanks. Since solids remain in the septic tanks, pipe diameters are smaller than for conventional gravity systems and manholes are not used in the

Seawater intrusion moved twice as far in the 4 years as in the previous 20

EXHIBIT "B"

LO Groundwater Basin Update

May 4, 2010



250 mg/l Water not recommended for drinking

500 mg/l Not drinkable (per Title 22)

60 mg/l Historic average in basin

Resource Capacity Study

Water Supply in the Los Osos Area

February 2007

San Luis Obispo County
Dept of Planning and Building

Executive Summary

This Resource Capacity Study (RCS) is an analysis of water supply and demand in the Los Osos groundwater basin. It is based on reports commissioned by the Los Osos Community Services District and prepared by the local hydrogeology firm of Cleath and Associates. According to the County General Plan, a Resource Capacity Study should: 1) inventory existing water resources available to the agency operating the system; 2) document existing demand for water by all area user groups; and 3) explore any conservation measures that could reasonably be imposed by the water agency.

A Resource Capacity Study results in a determination of a Level of Severity (LOS) of the resource. Levels are set at I, II or III:

Level I	Resource Capacity Problem
Level II	Diminishing Resource Capacity
Level III	Resource Capacity Met or Exceeded

The response to these established levels of severity can range from capital project funding requirements to restrictions on development.

This Resource Capacity Study has determined that there is a Level of Severity III for water supply in the Los Osos area. Recommended actions include implementation of aggressive water conservation measures, prohibition of subdivisions, and requirements that all water purveyors meter water use and adopt an ascending rate structure.

This RCS will be reviewed by the Planning Commission at a public hearing. The Commission shall hear testimony on the subject and will make a recommendation to the Board of Supervisors. The Board will then conduct a second public hearing on the matter. The Board may choose to “certify” the Level of Severity and adopt measures to bring the resource into balance. Alternatively, the Board may chose to certify a different level of severity and take some different action.

1.) <u>Introduction/Background</u>

This Resource Capacity Study was ordered by the Board of Supervisors in December 2005. The Board unanimously set a Level of Severity III for water supply and directed that a Resource Capacity Study (RCS) be prepared.

The Los Osos ground water basin is the only source for local municipal, private domestic and agricultural water supply in the Los Osos area. The onshore

portion of the Los Osos Valley ground water basin covers approximately 10 square miles, of which approximately 3.3 square miles underlie the bay and sand spit, and 6.7 square miles underlie Los Osos, Baywood Park, and the Los Osos Creek valley. When groundwater is pumped out of the lower aquifer, four potential sources of recharge are available for replenishment. These sources are the Los Osos Creek valley, the upper aquifer, bedrock, and sea water.

The Los Osos Valley ground water basin has a limited amount of sustainable water available for use, known as the basin safe yield. The basin safe yield is the amount of naturally occurring ground water that can be withdrawn from an aquifer on a sustained basis, economically and legally, without impairing the native ground-water quality or creating undesirable effects, such water supply problems or water quality degradation.

In 2002, the Los Osos CSD conducted a safe yield analysis for the Los Osos Valley ground water basin in its Water Master Plan. Indications showed that there is an imbalance between the upper and lower aquifer production, with too much production in the lower aquifer and too little production in the upper aquifer. The imbalance has caused sea water intrusion in the lower aquifer. Sea water intrusion is the movement of salt water into a fresh-water aquifer. It not only has an affect on the water quality of the aquifers, but the soil can be damaged as a result of sea water intrusion. Salt build-up is left behind when water evaporates and makes in difficult or impossible to grow crops.

A relatively low percentage of sea water in fresh (less than 5%) can have a significant adverse impact on the potential beneficial uses of the water. Sea water intrusion was first documented in deep basin sediments in 1977 and has been affecting water purveyor wells since the mid 1990's. At present, sea water intrusion is occurring in the western end of the ground water basin. Sea water intrusion is active in the lower aquifer due to basin overdraft. An overdraft is the condition of a groundwater basin or sub basin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years. Sea water intrusion is taking place in areas of the Los Osos Valley groundwater basin but to what extent is unknown.

The Resource Management System. The county's Resource Management System (RMS) is a mechanism for ensuring a balance between land development and the resources necessary to sustain such development. When a resource deficiency becomes apparent, efforts are made to determine how the resource capacity might be expanded, whether conservation measures could be introduced to extend the availability of unused capacity, or whether development should be limited or redirected to areas with remaining resource capacity. The RMS is designed to avoid adverse impacts from depletion of a resource.

The RMS describes a resource in terms of its “level of severity”, based on the rate of depletion and an estimate of the remaining capacity, if any. In response to a resource issue or recommended level of severity, the Board of Supervisors may direct that a Resource Capacity Study be conducted. The RCS provides additional details that would allow the Board to certify a level of severity and adopt whatever measures are needed to eliminate or reduce the potential for undesirable consequences. The Board of Supervisors directed the preparation of this RCS in December 2005.

This document is the Resource Capacity Study for water supply in the Los Osos Valley groundwater basin. It is organized in the following manner:

1. **Introduction/background**
2. **Summary of studies done**
3. **Discussion**
   - **a Methods for estimating safe yield**
   - **b. Safe yield/overdraft**
4. **Estimate of projected growth**
   - **a. Subdivisions**
   - **b. Vacant lots**
5. **Summary of water supply and demand**
   - **a. Purveyors**
   - **b. Private wells**
   - **c. Agricultural use**
6. **Measures to increase supply**
7. **Measures to extend resource capacity**
8. **Recommended level of severity**
9. **Recommended actions**

2. Completed studies

In 2003, the Los Osos Community Services District (Los Osos CSD) obtained a grant form the California Department of Water Resources (DWR) for a project consisting of two separate studies; an assessment of sea water intrusion in the Los Osos Valley ground water basin, and an investigation into the source of the lower aquifer recharge. These studies address issues that affect ground water resource management and planning for a sustainable community water supply.

Sea Water Intrusion Assessment

The purpose of the sea water intrusion assessment was to document the historical rate of advance of the sea water wedge and the transition zone, and to establish the current position of these elements. The lower aquifer system in the Los Osos Valley groundwater basin is currently experiencing sea water intrusion. Most of the community water supply is generated from the lower aquifer system;

therefore, understanding the extent and rate of sea water intrusion is critical to protecting the community water supply.

According to the Sea Water Intrusion Assessment, six aquifer zones have been identified in previously published reports. They include the alluvial aquifer in the Los Osos Creek valley, the perched aquifer (Zone A), the transitional aquifer (Zone B), the upper aquifer (Zone C), and the lower aquifer (Zones D and E). A regional clay aquitard averaging 50 feet in thickness separates the upper aquifer from the lower aquifer. Basin-wide ground water production averaged 3,480 acre-feet per year (afy) between 1985 and 2001, with 2,510 afy being drawn from the lower aquifer.

The Assessment describes the problem of seawater intrusion. Less than five percent sea water in a fresh water aquifer can have a significant adverse impact on the potential beneficial uses of the water. There are certain criteria for evaluating sea water intrusion. The criteria consist of water levels and water quality. The sea water border will move in response to changes in aquifer pore pressure and will move toward an approximate equilibrium based on the Ghyben-Herzberg relation.

The Ghyben-Herzberg relation is comprised of analytical solutions to approximate the intrusion behavior. These solutions are based on a number of assumptions that do not hold in all field cases. The Ghyben-Herzberg relation states, for every foot of fresh water in an unconfined aquifer above sea level, there will be forty feet of fresh water in the aquifer below sea level. According to the Ghyben-Herzberg relation, a fresh water head of approximately 5 feet would be needed to prevent the sea water interface from moving onshore within the upper aquifer. A fresh water head of approximately 9 feet would be required to prevent the sea water interface in the lower aquifer from moving inland. Currently, only upper aquifer water levels are sufficiently high enough to prevent sea water intrusion.

Regarding the sea water assessment for the Los Osos Valley groundwater basin, the Los Osos CSD concluded that:

1. The upper aquifer freshwater/ sea water interface is relatively stable beneath the Morro Bay sand spit, with a potential for active intrusion during extended drought periods.

2. Sea water intrusion in the lower aquifer (zone D) has advanced at an average rate of 60 feet per year between 1985 and 2005, and is currently between Pecho Road and Doris Avenue.

3. Sea water intrusion in the lower aquifer (zone E) has advanced at an average rate of 54 feet per year between 1977 and 2005, and is currently between Broderson Avenue and Palisades Avenue.

Lower Aquifer Recharge Assessment

The Sea Water Intrusion report also included an assessment of lower aquifer recharge. When ground water is pumped out of the lower aquifer, four potential sources of recharge are available for replenishment. These sources are the Los Osos Creek valley, the upper aquifer, bedrock, and sea water. It was concluded that the upper aquifer is the primary source of fresh water recharge to the lower aquifer. The assessment also concluded that lower aquifer production west of the Los Osos Creek valley is currently close to 600 acre-feet per year more than the average fresh water inflow. This is confirmed by the evidence of sea water intrusion. The Los Osos Valley ground water basin is currently in an overdraft condition.

3. Discussion

What is the "safe yield" of a groundwater basin?

Safe yield is the amount of naturally occurring ground water that can be withdrawn from an aquifer on a sustained basis, economically and legally, without impairing the native ground-water quality or creating an undesirable effect such as environmental damage (C. W. Fetter, Applied Hydrogeology, Third Edition, 1994). "Undesirable effects" frequently cited as consequences of exceeding safe yield include:

- Reductions in streamflow; reductions in lake levels
- Drying of wetlands
- Subsidence of the land surface
- Degradation of water quality
- In coastal locations, seawater intrusion into the aquifer's fresh water in storage
- Lowering water levels leading to increase in pumping cost

What methods are used to estimate the safe yield of a groundwater basin?

Water level analysis**.** Groundwater levels in wells fluctuate over time representing the continuous adjustment of groundwater in storage to changes in recharge and discharge. Fluctuation of water levels is caused by several factors, including pumpage, recharge from direct precipitation and streamflow, infiltration of applied water and subsurface inflows and outflows. Water level analysis is based on empirical measurement of water levels in both production wells and monitoring wells. Levels in individual wells are compared to levels in other wells

throughout an aquifer to create a contour map showing elevations of the groundwater surface. Contour maps are useful for estimating the direction and rate of flow of groundwater within an aquifer. They are also used for estimating the amount of groundwater in storage. Observation of water levels over time can illuminate trends with implications about the long-term prospects for the basin.

Because annual recharge from precipitation is highly variable, long-term analysis of water level trends must include representative periods of above average and below average rainfall. Determination of trends is based on a period of observation that is not biased by an unusually dry or wet year or series of years.

Water budget analysis. Compilation of a water budget provides an estimate of each source of recharge and discharge to and from an aquifer. Estimates are based on a combination of empirical observation (rainfall data, stream flows, core samples, chemical analysis, well levels) and inference using logical assumptions. Water budgets are prepared to enable an understanding of the ways in which the groundwater basin adjusts to changes in recharge and discharge.

Since natural recharge from precipitation cannot be increased, an increase in discharge (pumping) can only be offset by an equivalent decrease in other forms of discharge (i.e., outflow to the ocean, to streamflow, to evapotranspiration, transfer from storage) and/or by supplemental recharge (imported water, control of recharge by dams). "Dynamic equilibrium" is the process by which an aquifer adjusts to a change in recharge or discharge.

The most common change to deal with is increased pumping. Depending on the transmissivity and storativity of the aquifer, achievement of a new equilibrium may not take place for decades following an increase in pumping. Equilibrium is achieved when the water removed by pumping is replaced by water that would otherwise have been discharged via ocean outflow or other sub-surface outflow such as outflow to a local stream or lake or to evapotranspiration. The cause and effect relationship between pumping and changes in various forms of discharge is not always appreciated, because pumping happens at the turn of a switch while the discharge adjustments take place over a very long time.

During the lengthy period of adjustment, a year or two of above average rainfall can temporarily reduce the size of pumping cones of depression and raise water levels in wells, giving a false impression that additional pumping can take place without a significant impact on the aquifer.

4. Estimate of Population Growth

The current population of the Los Osos Valley is approximately 14,500 persons. Build out has been estimated in the revised Estero Plan at 19, 713. Water management documents and studies have used this figure. However, the Los

Osos portion of the Estero Plan has been "taken off the table" by the County and will not be considered by the California Coastal Commission. The previous version of the Estero Plan is now being put back into place. This document has a build out population of approximately 28,000. This build out population figure is not accurate and this report recommends the figure be reduced as part of a future plan amendment.

These figures all probably overestimate the short term increase in population of the Los Osos area. A survey of potential subdivisions and vacant parcels yields a much lower figure. The sites known as Holland, Morro Shores, the "Farm" and other possible subdivision sites have the potential to support approximately 500 new housing units. In addition, a survey of the community indicates that there are approximately 450 - 500 vacant parcels that could be developed in the future. A total of 1000 units could support a population of approximately 2200 – 2500 additional persons. Another 2500 persons could be added over the long term.

5. Summary of Water Supply and Demand

The water supply of the Los Osos Valley is primarily based in the lower aquifer of the valley's groundwater basin. There have been several studies focused on Los Osos Valley ground water issues:

1. Brown and Caldwell (1974): Safe yield at 1300-1800 acre feet year (AFY). This is questioned in Cleath, July 2005, where the 1800 AFY is said to be consumptive use and not gross water production. The correct number, according to Cleath, should be closer to 3750 AFY.

2. Dept of Water Resources (1989): The DWR report determined a safe yield of 2200 AFY thru the use of a USGS model. Cleath adjusts this number to 3140 AFY.

3. URS Corporation (2000): Uses 3150 AFY as safe yield. URS used an updated USGS model.

4. Cleath and Associates (2002): Cleath used multiple methods to estimate safe yield at 3560 AFY in the LOCSD Master Water Plan.

5. Cleath and Associates (2005): This newer Cleath report includes a discussion of sea water intrusion. This issue has caused Cleath to reduce safe yield estimates to 3250 AFY to keep sea water intrusion at bay.

The studies have established a safe yield from each of the sub-groundwater sources. The safe yield (3250 AFY) used in the latest report for the CSD (Cleath and Associates July 2005) will be used in this RCS.

Table 1
Safe Yield Estimate
(from Cleath 2005)

Storage Area	Current Conditions	
	LOCSD Master Plan	2005 Water Management Plan
Upper Aquifer	**1150**	**1150**
Lower Aquifer	**1610**	**1300**
Creek Valley	**800**	**800**
TOTALS	**3560**	**3250**

The safe yield figure in Table of 3250 AFY will be used for this RCS. This safe yield includes provisions for reductions in sea water intrusion.

The safe yield from the basin is one side of the supply and demand equation. The demand side can be estimated by adding the amount of water pumped by all types of groundwater users including purveyors, private domestic wells and agricultural use. The following table from Cleath 2005 uses data from the period 1985-2001:

Table 2
Ground Water Production
1985-2001

Aquifer Zone	Purveyors			Private Domestic	Agricultural Irrigation*	1985-2001 average	2001 prod.
	Golden State	LOCSD	S&T				
A, B	0	0	0	40	0	40	40
C, alluvium	250	230	50	120	330	980	810
D	820	630	60	40	400	1950	2170
E	0	280	0	0	220	500	380
Total	1070	1140	110	200	950	3470	3400

Total water production from all portions of the groundwater basin totaled 3400 AFY. This 2001 number is 150 AFY more than the calculated safe yield from the basin. These figures indicate the basin was in overdraft in 2001. Overdraft continues today is shown by the continued sea water intrusion problem in the lower aquifer.

Water Demand In the Los Osos Valley

The population of the Los Osos Valley has stayed roughly the same or has trended slightly upward since 1990. Water use is also expected to trend upward as new development occurs outside the prohibition zone and existing dwellings are remodeled or demolished and replaced with larger more modern structures. Water demand in the CSD and Golden State Water Company service areas for the year 2006 is as follows:

Table 3
Water Usage by Purveyor

	LO CSD	Golden State	S and T Mutual
# of connections	2750	2681	175
Acre-feet/year	947 AFY	908 AFY	96.1 AFY
Use per connection	**0.34 AF**	**0.34 AF**	**0.55 AF**

The water use figures for the LOCSD and Golden State service areas are relatively low. The water use figures for the S&T Mutual Co are especially high. The difference in water usage per connection may be attributable to S&T's billing method. The company does not meter water usage; instead everyone is charged a flat rate. This type of billing does not encourage water conservation.

Staff has reviewed other variables to check this assumption. The lot sizes in the Sunset Terrace area (S&T's service area) are a uniform 6,000 – 6,500 sq ft. No unusually large parcels exist in the area that would cause per connection water usage to be higher than other suburban areas. An explanation can be sought through an analysis of community water demand. A survey of other communities' water usage per connection is as follows:

Table 4
Water Use in Other Communities

	San Luis Obispo	Templeton	Morro Bay	Pismo Beach	Nipomo	Golden State (Nipomo)
# of connections	14425	2490	5449	4776	3968	1480
Acre-feet/yr	6001 AFY	1395 AFY	1211 AFY	1927 AFY	2674 AFY	1164 AFY
Use/Connection	**0.41 AFY**	**0.56 AFY**	**0.22 AFY**	**0.40 AFY**	**0.67 AFY**	**0.78 AFY**

The examples of water use in other communities show a wide range of demand per connection. According to the Dept of Water Resources, water demand can be affected by several factors:

1. Size of lot
2. Size of dwelling
3. Climate
4. Soils
5. Rate structure
6. Land use
7. Household income

The range of demand per connection shown in Table 4 can be explained by several of these factors. The relatively low water demand numbers in Morro Bay and Los Osos are probably attributable to the smaller lot sizes that are found in all of our coastal communities; the marine influenced climate, and in the case of Morro Bay, the high percentage of second or vacation homes that are not occupied on a full time basis.

Other factors to be considered include land use patterns and population. The Cities of Pismo Beach and San Luis Obispo have relatively higher per connection water demand than the South Bay communities. Pismo Beach has many vacation homes that arte not occupied full time; however, their demand figure of 0.67 AFY per connection is relatively high. Similarly, the City of San Luis Obispo's demand figure is higher than expected. The water demand in these cities is probably due to 1) the number of hotels and visitors that put a higher demand on water resources; and 2) the substantial difference between the "night time" and "day time" populations of San Luis Obispo. Other communities in the county have become bedroom communities for the commercial center of the county.

Other factors that can explain the wide range in water demand include climate and lot size. According to the Dept of Water resources, 65% of water usage occurs outside the home. The communities of Templeton and Nipomo contain lots that are much larger than other areas of the County. Larger parcels use more water. North County communities can expect to use more water than coastal or south county communities due to the hotter summer climate.

The only figure that cannot seem to be explained by these factors is S&T Mutual Water Company. The S&T service area includes 175 connections in a small area of Los Osos near the Sea Pines Golf Course. The lot sizes, as mentioned above, are small (6,000 – 6,500 sq ft) and all connections are uniformly residential. The climate is marine influenced and soil conditions are similar to the rest of Los Osos. Of all factors that affect water demand in the list above, the only one that seems germane to S&T is rate structure. This mutual water

company is the only purveyor in the community that does not meter water use. All users are charged a flat rate independent of water usage. Metering of water usage at each connection is necessary in Los Osos in order to address the overdraft condition.

Conclusions Regarding Water Supply and Demand

The groundwater basin is currently in overdraft by at least 150 AFY. Sea water intrusion, which is fatal to a fresh water aquifer, is occurring in the Los Osos groundwater basin. Therefore, it is absolutely imperative that all measures are brought to bear to correct this problem. Lowering demand for water is generally the least expensive method to bring the basin back into equilibrium and to halt sea water intrusion. Therefore, while a RCS should look at measures to increase supply, this report shall focus on measures to reduce demand.

6. Measure to Increase Supply

A supplemental water source will eventually be needed for the area. The community is relatively isolated on the coast and is some distance from large surface water projects that could deliver supplemental water.

The few feasible options include:

1. Water wheeling through the City of Morro Bay (State water/desal)
2. Reclaimed water from the future wastewater treatment plant
3. Local Desalination facility
4. Conservation
5. Agricultural water

The water purveyors should review these options for supplemental water. Water wheeling through Morro Bay could include use of State Water or use of water produced by the existing desal plant. A pipeline connection from the City to Los Osos would be required. The pipeline route would probably be along South Bay Blvd and would experience coastal permitting and environmental difficulties. Water from a desal plant would probably cost upwards of $4000 per acre foot/year (Nipomo RCS – 2006). State water costs could run in the range of $1000- $2500 per acre foot per year.

Agricultural water users are located primarily on the east, southeast and northeast sides of the community. A GIS review of acreage in irrigated crops shows approximately 480 acres in irrigated agriculture. Crops in the area require between 1 to 3 acre feet of water per acre. A middle estimate of 2 acre feet per acre results in a water demand of 960 acre feet per year. This is similar to the estimate of agriculture water use by Cleath. Purchase of the water rights from these agricultural users will have serious general plan policy implications.

The use of reclaimed water from the future wastewater treatment plant should be considered. However, as a system design has not yet been completed and the areas of potential use of reclaimed water remain unclear, this option requires additional study. Also, tapping the upper aquifer to augment water supply is possible.

These are the acknowledged difficulties in securing a supply of supplemental water for the community. However, the existing information reviewed for this RCS clearly indicates a need for such a supplemental water supply. It appears that supplemental water is needed in the future even with a scenario of 0% growth and an aggressive water conservation program in place.

7. Measures to Extend Resource Capacity

Generally, the least expensive method to gain "new" water supply is through water conservation. According to the Pacific Institute (The Potential for Water Conservation in California, 2003):

> "Even without improvements in technology, we estimate that indoor residential use could be reduced by approximately 890,000 AF/yr – almost 40 percent – by replacing remaining inefficient toilets, washing machines, showerheads, and dishwashers, and by reducing the level of leaks. All of these savings are cost-effective and have important co-benefits like saving energy and decreasing the amount of waste water created."

It is questionable whether such a water savings figure is attainable in a single community. The Los Osos CSD's Water Management Plan assumes a 200 acre foot/year savings from water conservation by the year 2010. The Nipomo Water Management Plan assumes a 15% savings from water conservation measures. With water demand in Los Osos at 3400 AFY, a reasonable savings through conservation could be as high as, say 10% or 340 AFY. Even this amount of water savings is not enough to balance the demands on the aquifer and supplemental water will eventually be needed.

An aggressive water conservation program is required immediately due to the overdraft condition. A conservation program should require:

1. Mandatory retrofitting of all indoor plumbing fixtures including toilets, shower heads, sinks, washing machines.
2. A steeply tiered water rate structure that heavily penalizes excessive water use.
3. Prohibition of subdivisions that result in a net increase in water use.

4. Outdoor water use restrictions.
5. Metering of all water connections.

The Pacific Institute suggests the following rate structure:

Table 5. Recommended Tiered Rate Structure
Pacific Institute

Tier	Water Use (as percent of base allocation)	Price per Unit Used in Each Tier
Low Volume Discount	0-40%	Base Rate
Conservation Base Rate	41-100%	Base Rate
Inefficient	101-150%	2x Base Rate
Excessive	151-200%	4x Base Rate
Wasteful	201% and above	8x Base Rate

The CSD and Golden State Water Co have commenced changes in well production to decrease the amount of water taken from the lower aquifer. This is the first recommendation from the Sea Water Intrusion Assessment. The purveyors should continue these efforts.

The Los Osos groundwater basin is currently undergoing a process known as adjudication. The CSD filed the case for adjudication in February 2004. The water purveyors (LOCSD, Golden State Water Co, S&T Mutual Water Co and the County) are involved in this court case. In an adjudication case, the parties overlying the groundwater basin turned to the courts to settle disputes over how much groundwater can rightfully be extracted by each party.

Currently, the parties involved in the adjudication case are in discussion of a proposed interim stipulated agreement. The proposed agreement is not yet final and is not a public document. It is not known at this time what effect the stipulated agreement will have on the water resource in the Los Osos groundwater basin.

8. RECOMMENDED LEVEL OF SEVERITY

The county General Plan's *Framework for Planning* contains a discussion of the objectives, procedures and criteria for levels of severity of the Resource Management System. Regarding water resources, the RMS indicates that *"Level of Severity III exists when water demand equals the available resource; the amount of consumption has reached the dependable supply of the resource. A*

Level III may also exist if the time required to correct the problem is longer than the time available before the dependable supply is reached."

Table 6 RESOURCE DEFICIENCY CRITERIA FOR LEVELS OF SEVERITY		
Level I	**Level II**	**Level III**
Projected consumption estimated to exceed dependable supply within 9 years	7 year lead time to develop supplementary water for delivery to users	Resource is being used at or beyond its estimated dependable supply or will deplete dependable supply before new supplies can be developed

This Resource Capacity Study confirms that for the Los Osos community, water demand presently exceeds the dependable yield. Therefore, Level of Severity III is recommended for the water resources in Los Osos.

9. Recommended Actions

The Resource Management System includes three "action requirements" that accompany a Level of Severity III determination:

If Level III is found to exist, the board shall make formal findings to that effect, citing the basis for the findings, and shall:

1. *Institute appropriate measures (including capital programs) to correct the critical resource deficiency, or at least restore Level II so that severe restrictions will be unnecessary.*
2. *Adopt growth management or other urgency measures to initiate whatever restrictions are necessary to minimize or halt further resource depletion.*
3. *Enact a moratorium on land development, or other appropriate measures, in the area that is affected by the resource problem until such time that the project provides additional resource capacity to support such development.*

The following measures are recommended for implementation:

1. <u>Measures to correct the resource deficiency.</u>

The county can initiate measures that involve the land use and building permitting process. However, since the county is not a water purveyor in Los Osos, some of these measures will need to be undertaken by the LOCSD, Golden State Water Company and S&T, acting separately or as part of a coordinated effort.

Measures to be undertaken by water purveyors:

a. Continue to immediately implement the measures recommended in the Sea Water Intrusion Assessment.
b. S&T Mutual Water Co. should install meters and adopt an ascending water rate structure as described above.
c. All water purveyors should immediately adopt an ascending water rate structure as described above.
d. All water purveyors should adopt mandatory retrofit measures that will reduce water demand by 15% by the year 2010 compared to 2001 usage.
e. Secure supplemental water supplies in sufficient quantity, when combined with conservation measures, to meet demand at projected buildout.

2. Land development measures:

Measures to be undertaken by the County:

f. Prohibit new subdivisions that result in the net increase in water usage from the basin.
g. Institute water conservation requirements for parcels outside of water purveyor service areas that mirror the efforts undertaken by purveyors within their service areas.
h. Adopt an ordinance requiring all water purveyors with 5 or more connections to meter individual connection water use.
i. Reduce the build out figure for Los Osos in the Estero Area plan. From the present 28,000 to 19,713.

References:

Los Osos Community Services District. *Sea Water Intrusion Assessment and Low Aquifer Source Investigation of the Los Osos Valley Ground Water Basin San Luis Obispo County, California.* October, 2005.

Los Osos Community Services District. *Water Management Plan for the Los Osos Valley Ground Water Basin.* July 2005

San Luis Obispo County Department of Planning and Building. *Resource Capacity Study: Water Supply in the Nipomo Mesa Area.* October, 2004.

7

Department of Planning and Building
San Luis Obispo County

Alex Hinds, Director
Bryce Tingle, Assistant Director
Barney McCay, Chief Building Official
Norma Salisbury, Administrative Services Officer

DATE: JUNE 25, 1992

TO: PLANNING COMMISSION

FROM: JOHN HAND, ADVANCE PLANNING JH.

VIA: ALEX HINDS, AH DIRECTOR, PLANNING & BUILDING DEPARTMENT

SUBJECT: LOS OSOS VALLEY GROUNDWATER BASIN
RESOURCE CAPACITY STUDY

SUMMARY

The capacity of water systems in the Los Osos Valley groundwater basin is exceeded by demand, based upon analysis of current use patterns and the basin's estimated long-term sustainable yield.

In accordance with procedures specified by the Resource Management System, this information was communicated to the Board of Supervisors via the Annual Resource Summary Reports for 1990 and 1991. The 1990 report included a recommended level of severity II for the groundwater basin. The 1991 report recommended that the level II be changed to level III, based upon further evaluation of the data.

In approving the 1990 report on March 12, 1991, the Board directed staff to prepare a resource capacity study for the purpose of confirming the recommended level of severity. On January 14, 1992, the Board approved a proposed work program for the resource capacity study, a copy of which is attached. RMS procedures require that the Planning Commission hold a public hearing on the resource capacity study and transmit the study to the Board of Supervisors with appropriate recommendations. The resource capacity study is transmitted herewith for consideration by the Planning Commission.

RECOMMENDATION

The Planning Commission should recommend to the Board of Supervisors that:

1. The recommended level of severity III for the water system serving the Los Osos Valley groundwater basin should be certified;

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2. The recommended level of severity II for the basin's water supply should be certified;

3. The three major water purveyors in the Los Osos area should cooperatively implement conservation measures, as specified in the resource capacity study;

4. The County, through CSA #9, and the other major water purveyors, should cooperatively perform additional investigations, as specified in the resource capacity study, to provide more definitive information upon which to base future recommendations;

5. The County should estimate the effect of relocating coastal wells on the current seawater intrusion problem and prepare a schedule for implementing the relocation;

6. The water supply for the Los Osos area should be increased by an amount which would assure the necessary ocean outflow to prevent seawater intrusion, less the annual reduction in extractions attributable to conservation measures implemented by the basin's water purveyors in response to recommendation 3., above. Within one year of the acceptance of this resource capacity study, a commitment should be made to some method, or combination of methods, for achieving this result;

7. A moratorium should be enacted which would apply to all land divisions within the South Bay Urban Reserve Line. While residential building permits could continue to be accepted for processing, it should be noted that most of the land area within the URL is already subject to the sewer moratorium.

8. The Planning and Engineering Departments should review additional water level data when it becomes available and advise the Board of Supervisors if changes to these recommendations would be appropriate, based upon the new information.

DISCUSSION

See attached resource capacity study.

OTHER AGENCY INVOLVEMENT

This study was prepared by the Planning Department, with significant collaboration with the Engineering Department. Implementation of the study's recommendations will be the responsibility of both departments.

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Cons.

FINANCIAL CONSIDERATIONS

The recommended conservation measures would result in some expense to the county, since County Service Area No. 9 is one of the water purveyors in the area. It is estimated that implementation of the recommended measures would involve an annual operating cost of approximately $1200 to cover materials (readily available) and postage.

The cost of the recommended groundwater studies is as follows:

* Sampling salinity, first year, on a quarterly basis; analysis of five wells and preparation of reports	$2500 to $3200
* Annual sampling, thereafter, five wells	$600 to $750 / yr
* Annual review of data / trends; summary report to RMS	$1500 / yr
* Study to evaluate potential effectiveness and strategy for re-locating coastal wells; expanded simulation modelling from USGS report to evaluate potential for well relocation	$15000 to $25000

Los Osos Community Advisory Committee (LOCAC) meeting 7/23/09: Comments of Supervisor Bruce Gibson regarding a Coastal Commission letter sent to the County:

:

As to the letter from the Coastal Commission, which is really the only other thing that I heard looking for a response on, Paavo indicated he was very pleased to have that letter come forward at this time. It lays out a lot of issues that need to be addressed before the project is complete. I would only observe, on a couple of notes, that, first of all, that letter is from Coastal Commission staff, and it's not from the Coastal Commission. So that's an important issue, because it's going to be the commissioners themselves that are going to make the determinations on the project when it comes before them. As we look through that letter, this is a staff out of the Santa Cruz office that is extraordinarily strapped for time; they're stretched very, very thin. And in reading the letter, you'll see certain conclusionary statements that they make, and so far as we can tell, they're not very well informed on the actual technical issues behind the issues. And the other aspect of that is that we continue to work with staff. They just have not had time to look into this in any great amount of detail. These are concerns that we have talked to them at some other times. Paavo will be talking to staff to staff project team to the Coastal Commission. My sense - well, it's clear that these issues are going to have to be resolved. And there are basically two ways of resolving them - one is to change the project and the other is to change the minds of Coastal Commission staff. And my estimation is that there's going to be more changing of the mind of the Coastal Commission staff than there is actually going to be changes to the project involved. We continue to monitor that, and we will look forward to the conclusion of the Planning Commission hearings.

Transcribed from video record

May 13, 2010

Central Coast Regional Water Board
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401-7906

Subject: Request for the Regional Board to take specific actions immediately to stop degradation of the water supply in the Los Osos Valley Water Basin.

Dear Board Members,

The Los Osos Sustainability Group (LOSG) is requesting that your Board take specific and immediate actions to stop the degradation of the groundwater supply in the Los Osos Valley Water Basin. The actions we request are listed below and in Attachment A. Some of the actions are the same actions your Board and staff have developed and implemented for the *Salinas River Watershed Management Action Plan* discussed in the "Watershed Management Initiative (WMI)" chapter of the Region 3 *Basin Plan*.

The community of Los Osos relies on the basin as its sole source of water. We are concerned that degradation of the basin due to seawater intrusion and other controllable contamination poses an immediate threat to this resource. Moreover, failure to stop seawater intrusion could render the Los Osos Wastewater Project (LOWWP) unable to achieve its primary purpose—the improvement of water quality to establish a sustainable basin. State and federal laws grant the Regional and State Water Boards, and other agencies, the authority and responsibility to prevent destruction of this vital resource—and all public agencies are charged with avoiding the unnecessary use of public funds.

As you know, the County and water purveyors are developing a basin management plan as part of an adjudicated basin process. San Luis Obispo County officials have said that this management plan will balance the basin and stop seawater intrusion, even with future development. The County and water purveyors recently released an update of the basin planning process, along with two technical memoranda, an update of basin water quality (focused on chlorides from seawater intrusion), and a peer review of the July 2009 Cleath-Harris, Geologies, Inc., technical memoranda (which provide the technical basis for purveyor basin planning, e.g., including safe yield estimates and sustainable management scenarios.

These reports are alarming, and we think they will be for you too, for the following reasons: 1) seawater has accelerated, moving at least as far in the past four years as in the previous twenty, 2) contamination of the groundwater from seawater intrusion is nearing levels that can cause key supply wells to shut down, 2) the purveyor basin planning process has fallen a year behind schedule in just six months and will not (and cannot) provide the comprehensive and immediate response needed to address a crises of this magnitude within the timeframe required to avert the disaster, 4) the County continues to avoid its responsibility to manage the basin although the County is clearly responsible for the welfare of citizens in the area, including our water supply, and, finally, 5) the LOWWP project—now in the final stages of review before the Coastal Commission will not be able to achieve its intended purpose—help create a sustainable groundwater supply—if seawater intrusion destroys the basin.
The seriousness of the problem requires your Board to declare seawater intrusion a "high-priority" problem, set water quality objectives immediately, create a water quality control plan,

and help coordinate the development and implementation of a basin-wide management plan for the basin.

Your Board or staff will soon be setting permit requirements for the LOWWP. These must support an intensive, integrated action plan to achieve water quality objectives. Also, your Board still has time to support Coastal Development Permit conditions for the project, emphasizing conservation, beneficial reuse, and low impact development recharge, to help ensure a sustainable basin and viable project.

To preserve the Los Osos basin and assure a viable LOWWP project, we are requesting that your Board take the following specific actions immediately.

1. Request and review the purveyor basin management plan, the current seawater intrusion assessment, and the peer review of the 2009 Cleath-Harris Technical Memoranda, in order to evaluate the accuracy and completeness of the reports, consistency with policies and laws, and the effectiveness of proposed measures. Also, request and review all drafts and supporting reports and data for review, and conduct the reviews in public forums.

2. Conduct, coordinate, and consider independent testing and analysis of the basin to assure an objective and complete assessment of the basin and evaluation of alternative management strategies/measures.

3. Set water quality objectives for chlorides, nitrates, and other pollutants of concern) to preserve and restore the highest beneficial uses of the water, update the regional water quality control plan with specific action steps to achieve water quality objectives within a timeframe that assures a sustainable basin, and add the objectives and plan to the Regional Basin Plan with a Basin Plan Amendment. (Water quality objectives should set targets at historical low levels for the upper and lower aquifers.)

4. Designate the Los Osos area a "high-priority" watershed and seawater intrusion a "high-priority problem." Coordinate resource protection agencies and other stakeholders in the development and implementation of a Watershed Management Action Plan for the area (which includes a basin-wide management plan) with specific strategies and action steps to achieve water quality objectives within a timeframe that assures a sustainable basin, and add the plan and strategies to the Watershed Management Initiative (WMI) chapter of the Regional Basin Plan and Strategic Plan of the State Water Resources Control Board and Department of Water Resources. See Attachments A & B for some specific requested actions for the watershed management action plan.

6. Formally support Coastal Development Permit (CDP) conditions for the LOWWP, which maximize conservation, beneficial reuse, and habitat protection measures for the LOWWP—in addition to a condition to implement a basin-wide management plan, with basin-wide ordinance, to reverse seawater intrusion and achieve water quality objectives as part of the area Watershed Management Action Plan. As lead agency for the LOWWP, the County Resource Management System, and the Flood Control and Conservation District, the County of SLO has the authority and responsibility to implement a basin-wide plan, and a basin-wide ordinance, to preserve the basin. An integrated, basin-wise plan, maximizing conservation (especially in a threatened basin) is

consistent with Regional and State Water Board policies and the Department of Water Resources *California Water Plan*. Also, Local Coastal Plan Watershed Policy 5 calls for a basin-wide comprehensive program, developed in cooperation with the Regional Board and other stakeholders to address groundwater quality (see Attachment C).

7. Set requirements for (amend, approve, and/or deny, as necessary) all WDRs, Nutrient Management Plans, Recycling Permits, Septic Discharge Permits, Septic Management Plans, Sanitary Sewer Management Plans, Stormwater Permits, Stormwater Management Plans, and enforcement actions within the basin (e.g., for the LOWWP, purveyor basin plan, and farms), in order to reverse seawater intrusion, achieve water quality objectives, and complete plan targets and actions (i.e., the plans referred to in #4-6 above)

8. Support and assist with grant and low-cost funding for the purpose of reversing seawater intrusion, achieving water quality objectives, and completing plan targets and actions (i.e., the plans referred to in #4-6 above).

State and local agencies charged with the protection of the Los Osos Valley Water Basin have failed to act effectively to reverse seawater intrusion since becoming aware of the problem in the early 1980's. During that time, the Regional Board has focused almost exclusively on reducing nitrate pollution in the upper aquifer by eliminating septic systems. This is just one possible action that should have been taken to protect and restore the Los Osos water basin.

The magnitude of the seawater intrusion problem, and the immediate threat it poses to the sustainability of the resource requires that your Board take immediate action. The long delay in effective management of the Los Osos Basin necessitates that actions are intensive, well-coordinated, comprehensive, and immediate. Anything less will result in the loss of this irreplaceable, finite resource.

We request that you agendize and approve these (and all other necessary actions) at your next board meeting, and develop and implement the action plans immediately. If any of the actions require emergency meetings, we request that you schedule them.

Sincerely,

Elaine Watson Keith Wimer Martha Goldin Piper Reilly
Los Osos Sustainability Group Executive Committee

(Also see Attachments A-C)

Copies sent electronically and by U.S. mail: Central Coast Regional Water Quality Control Board, County of San Luis Obispo, Department of Water Resources, State Water Resources Control Board, California Coastal Commission, California Department of Public Health, California Public Utilities Commission, California Senator Sam Blakeslee, U. S. Congresswoman Lois Capps.

ATTACHMENT A

Requested specific actions for the water quality control, watershed management, and basin-wide management plans

(Not intended to be exhaustive. Please see actions above, the Salinas River Watershed Management Action Plan, and the attached basin-wide management plan condition recommended by the LOSG for the LOWWP Coastal Development Permit).

With public input and in cooperation with the County and other stakeholders

- notify and bring together stakeholders
- specify stakeholder roles in achieving water quality objectives
- help develop and implement outreach and educational programs to alert the public and all stake holders to the serious seawater intrusion problem, stakeholder roles, and plans to reverse seawater intrusion
- determine the methodology and set specific benchmarks for measuring progress toward, and achievement of, water quality objectives
- assist the County in developing and implementing an ordinance to achieve the objectives or water quality objectives and plans
- provide for on-going monitoring and assessment for contaminants of concern by Water Board staff or an independent expert (and provide for reviews of assessments by independent experts).
- help develop and implement plans that maximize basin-wide conservation, beneficial reuse, and low impact development (LID) measures and programs to achieve the greatest possible benefits for seawater intrusion, basin water quality, and environmentally sensitive habitat (see summary of LOSG recommended Coastal Development Permit conditions—Attachment B).
- develop and implement specific nitrate management plans, septic system management plans, water quality certification standards, which maximize benefits on basin water quality and environmentally sensitive habitat.
- identify and implement appropriate enforcement actions to achieve water quality objectives
- help develop and implement procedures and standards for complete, accurate, and detailed water extraction and water delivery information to enable accurate assessment of water management programs and progress toward water quality objectives.
- support and help form a voluntary non-governmental organization (NGO), with an Executive Committee and Technical Advisory Committee, to assist in the administration of a basin-wide plan (e.g., to administer grants, develop specific programs, and recommend continuous improvements of the programs). The NGO's Executive Committee would be comprised of members from resource regulator agencies, environmental groups, citizens groups, and purveyors; and the TAC would be comprised of experts, mostly from the watershed institutes of CSU campuses, e.g., Monterey and Cal Poly SLO).

Requested requirements/conditions for Water Board permits within the watershed and basin

- No permit is approved for new development until/unless seawater intrusion is demonstrated to be reversed, ample groundwater reserves are proven to be high enough to reverse the seawater-freshwater gradient so that freshwater is flowing toward the sea and a margin of safety exists (i.e., groundwater surplus) adequate to provide a buffer against droughts, climate change uncertainties, and error in basin modeling.
- All permits require applicants to meet conservation water use, reuse, stormwater recharge (LID), and other plan targets, developed to maximize progress toward achieving water quality objectives, reversing seawater intrusion, and developing basin reserves (e.g., 74 gpcd total indoor-outdoor single-family residential conservation water use).

Recommended Water quality objectives for chlorides and nitrates based on historical contaminant levels

- Chlorides in the lower and upper aquifers—50 mg/l
- Nitrates in the upper aquifer—5 mg/l; Nitrates in the lower aquifers—2 mg/l

ATTACHMENT B

Summary of Los Osos Sustainability Group's Recommended Coastal Development Permit Conditions

We request the Board contact the Coastal Commission to support the following**:**

1. ***Amended Condition 99 requiring an intensive indoor-outdoor conservation program to be implemented within one year of project approval to reduce pumping by 25%, about 400 AFY, in the prohibition zone, in order to reduce pumping from lower aquifer from wells vulnerable to seawater intrusion and help assure a safe level of mitigation for the project.*** (Note: The Staff Report dated May 8, 2009, states the Regional Board encourages intensive mandatory conservation in overdraft situations, p. .)

2. ***Amended Condition 97 requiring a recycled water use program to be implemented upon project start up that allocates all recycled water from the project to agricultural exchange, urban reuse, and/or environmentally sensitive habitat.*** (Agricultural exchange and urban reuse provide the greatest seawater intrusion mitigation because they can offset pumping from the aquifers. Emphasizing agricultural exchange and urban reuse allows for further reduced pumping of the lower aquifers and/or limited pumping of the upper aquifer to adapt to impacts from the project.)

3. ***New Condition 112 requiring the County to implement a basin-wide management plan in cooperation with the Regional Water Board and other stakeholders (per Local Coastal Plan Watershed Policy 5), which is implemented with an ordinance and integrates the conservation and reuse conditions above (and other project water management conditions).*** The plan sets an objective of stopping seawater intrusion within two years of project start up, and it sets a target of reversing seawater intrusion (and creating groundwater reserves) within 5 years of project start up. It also provides for a non-governmental organization with a technical advisory committee to assist the county in developing, implementing and administering the program.

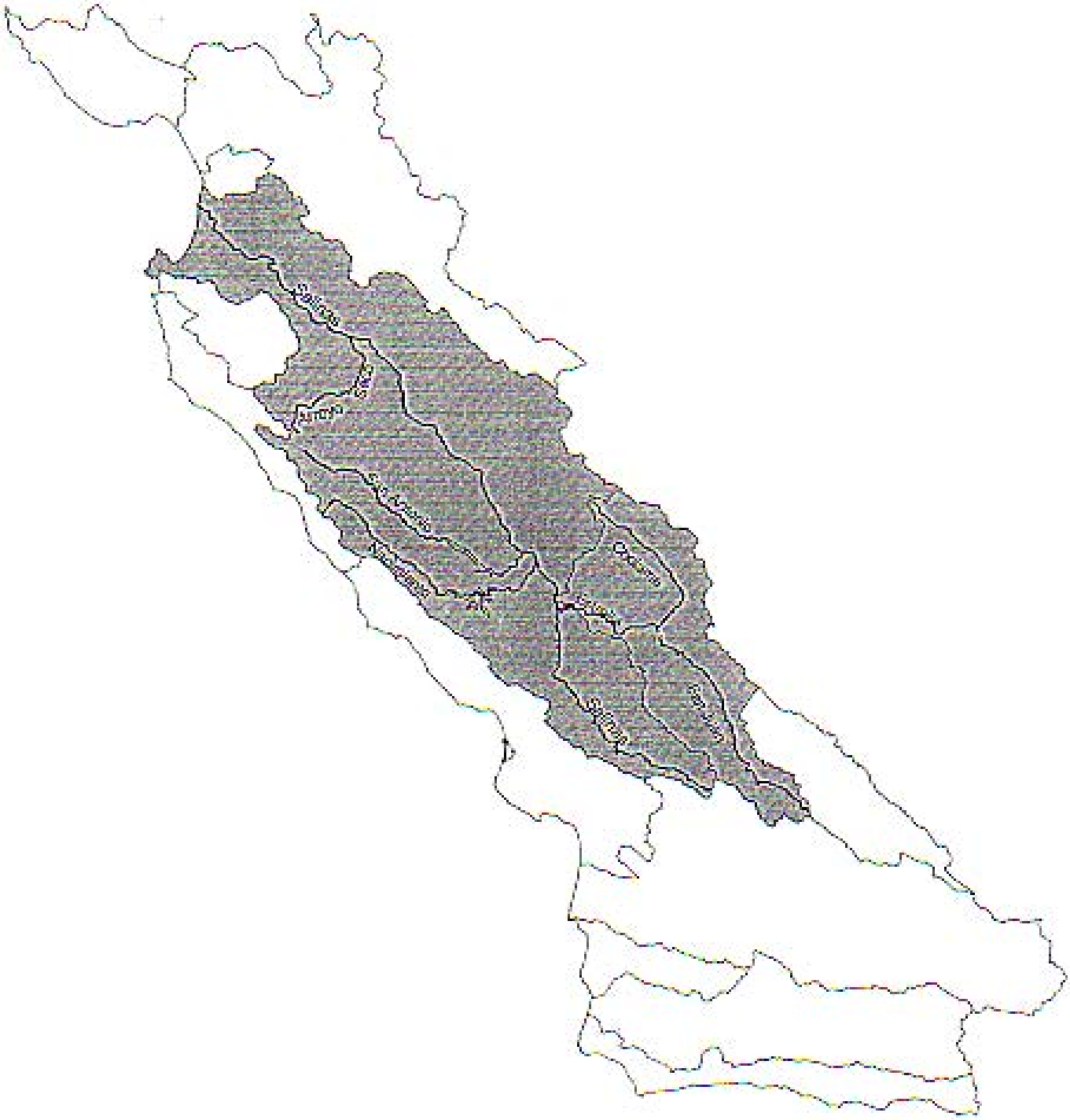
ATTACHMENT C

LCP Coastal Watershed Policy #5: "Los Osos Groundwater Management"
The county Planning and Engineering Departments should work with communities, property owners and the Regional Water Quality Control Board to develop and implement a basin-wide water management program for the Los Osos groundwater basin which addresses:

-existing and potential agricultural demand
-urban expansion in relation to water availability
- groundwater quality
-possible need for alternative liquid waste disposal
-protection of aquatic habitats including coastal waters, streams and wetlands.

The Resource Management System of the Land Use Element provides a framework for implementing this policy and an interim alert process for timely identification of potential resource deficiencies, so that sufficient lead time is allowed for correcting or avoiding a problem."

Salinas River Watershed Management Action Plan



Central Coast Regional Water Quality Control Board
October 22, 1999

SALINAS RIVER WATERSHED MANAGEMENT ACTION PLAN

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SALINAS RIVER WATERSHED MANAGEMENT ACTION PLAN

Executive Summary

The purpose of the Salinas River Watershed Management Action Plan is to describe the Central Coast Regional Water Quality Control Board's (Regional Board) approach to watershed management for the Salinas River drainage area. The goal of watershed management is to more effectively protect and improve water resources by supporting development of local solutions to local problems. The Regional Board has broad authority to control both point source and nonpoint source pollution through implementing Federal and State laws and regulations. Historically, most effort has focused on controlling point source pollution through a system of federal and state permits and enforcement actions. However, many significant identified water quality impacts in the Salinas River watershed, such as erosion and sedimentation, nitrates in ground water and surface waters, and older, discontinued pesticides in sediments and animal tissues, are primarily associated with nonpoint pollution sources. Additionally, widespread pumping of ground water has contributed significantly to seawater intrusion into coastal aquifers. The result is another significant nonpoint source impact to both water quantity and quality.

Typically, nonpoint source pollution results when water moves across the landscape and picks up pollutants from roads, parking lots, lawns, agricultural fields, mining areas, construction sites and other land uses. These pollutants are carried into streams, rivers and ground water, where they affect water quality and the beneficial uses of the waters. Control of nonpoint source pollution requires the efforts of individuals, local governments and resource agencies. An effective watershed approach, emphasizing cooperative solutions, increased education, and development of partnerships, will improve control of nonpoint source pollution, while enabling the Regional Board to continue effective oversight and control of point source discharges.

The most significant elements of the Regional Board's watershed approach include devoting additional resources (staff time and grant funding) to watershed activities, increasing Regional Board presence in the watershed through developing partnerships with landowners, local governments, resource agencies, and other stakeholder groups. A closely related internal effort will be to integrate existing Regional Board programs and improve internal communication and coordination to increase efficiency and provide better service. Through the combined efforts of many individuals, groups, and agencies with responsibilities and interests in the watershed, the Regional Board believes significant gains in water resource protection will be realized.

Description of the Salinas River Watershed

The watershed of the Salinas River and its tributaries covers approximately 4,600 square miles (nearly 3 million acres) and lies within San Luis Obispo and Monterey Counties (Figure 1). The Salinas River, which originates in San Luis Obispo County, flows northwestward into Monterey County, through the entire length of the Salinas Valley and empties into Monterey Bay. The watershed's main tributaries are the Arroyo Seco, Nacimiento, San Antonio, and Estrella Rivers. The two primary ground water basins within the Salinas watershed are the Salinas Valley Ground Water Basin and the Paso Robles Ground Water Basin (Figures 2 and 3).

The Salinas River drains a large watershed with a number of distinct tributaries; however, geographic, political, land use and ground water divisions facilitate discussion of the Salinas River watershed in terms of an upper and a lower watershed. The upper watershed begins at the headwaters of the Salinas River in the La Panza Range southeast of Santa Margarita Lake in San Luis Obispo County and flows to the narrows area near Bradley, just inside Monterey County. The upper watershed includes drainages of the Estrella, Nacimiento and San Antonio Rivers. The upper watershed overlies the Paso Robles Ground Water Basin and lies mainly in San Luis Obispo County. The lower watershed extends from the Bradley narrows area to Monterey Bay and includes the drainage of the Arroyo Seco River. The lower Salinas River watershed overlies the Salinas Ground Water Basin and is entirely within Monterey County.

Agriculture is the primary land use within the entire Salinas River watershed. Grazing and pasture lands and dryland farming have historically been the dominant land use in the upper watershed, but large areas in southern Monterey County and northern San Luis Obispo County are being converted to vineyards. Irrigated cropland is predominant in the lower watershed, primarily row crops such as lettuce, celery, broccoli and cauliflower on the valley floor, with grazing and vineyards on the upland areas. The lower watershed is one of the most productive agricultural areas in the world, with a gross annual value of nearly $2 billion. The rapidly expanding wine-producing region in the upper watershed around Paso Robles is also becoming a highly productive agricultural area.

Urban development occurs primarily in a corridor along the Salinas River. The largest city, Salinas, has more than 100,000 people and is developing rapidly. Urban development in the upper watershed is occurring in the small cities of Santa Margarita, Atascadero, Templeton and Paso Robles, which are also growing rapidly.

In addition to agriculture and urban development, other land uses in the Salinas River watershed include two military facilities (Fort Hunter Liggett and Camp Roberts), exploitation of mineral and oil reserves in the San Ardo area and a few other locations throughout the watershed, and some public land and open space. The watershed has three dams, one on the upper Salinas River south of Santa Margarita, one on the Nacimiento River and one on the San Antonio River.

Assessment of Water Resource Issues

Staff completed a preliminary assessment of water resource issues in October 1997. Available monitoring data, although not exhaustive, indicate water quality impacts are widespread. Identified impacts include seawater intrusion in the coastal areas near Castroville and Salinas, nitrates in ground water and surface water, pesticides in sediment and animal tissues, mercury in Lake Nacimiento and its tributaries, and erosion and sedimentation. The Paso Robles Ground Water Basin includes an area where highly mineralized geothermal wells contribute to ground water pollution. Pollutants such as pesticides, nutrients and sediment are often associated with agricultural activities, although agriculture is not the only source. Other potential pollutant sources in the watershed are urban storm water runoff, mines, oil fields, geothermal areas, roads and highways, and point source discharges.

The Salinas River and several tributaries have been listed by the Regional Board on the Clean Water Act's 303(d) list of impaired water bodies. Impaired water bodies are those waters which do not fully support all of their designated beneficial uses. All waterbodies on the 303(d) list are scheduled for development and implementation of Total Maximum Daily Loads (TMDLs) within the next several years. Developing and implementing a TMDL is a process which includes identification of sources and allocation of load reductions needed to restore beneficial uses. TMDLs are further described below and in Appendix A. along with a table of currently scheduled TMDLs (Table One). The Regional Board will work closely with landowners and other stakeholders in the watershed to ensure that the watershed approach is coordinated with all TMDL efforts.

In January 1999, the Regional Board's Regional Monitoring Program began monitoring the Salinas River and some of its tributaries to provide current ambient water quality data. In addition, the Regional Monitoring Program has gathered water quality data from numerous agencies and is in the process of creating a complete bibliography of references and a database of water quality data for the Salinas River. The Regional Monitoring Program, along with landowner and citizen monitoring, and TMDL development, will enable the Regional Board to further refine its assessment of water resource issues over the next two years.

Regional Board Responsibilities and Regulatory Authority

The Regional Water Quality Control Boards have responsibility for protecting the quality of the waters of the State of California. Waters of the State are defined as any surface and ground waters, including saline waters, within the boundaries of the State. Regional Boards protect water quality by implementing a number of Federal and State laws and regulations, including the Federal Clean Water Act (CWA), the State Porter-Cologne Water Quality Control Act, and the Coastal Zone Act Reauthorization Amendments (CZARA).

The State Water Resources Control Board and the nine Regional Boards were established by the Porter-Cologne Water Quality Control Act nearly 30 years ago. Under Porter-Cologne (promulgated as Division 7 of the California Water Code), Regional Boards are required to develop water quality control plans (Basin Plans), which describe the Regional Board's approach

for protection of water quality. Basin Plans identify beneficial uses for all of the region's waterbodies, including rivers, streams, bays, estuaries, wetlands and ground water basins, and establish standards for water quality (water quality objectives) which ensure beneficial uses are protected. Objectives can be numeric (e.g. the concentration of nitrate in drinking water shall not exceed 45 milligrams per liter) or narrative (e.g. suspended sediment shall not adversely impact beneficial uses). The Central Coast Regional Board's Basin Plan lists twenty-two beneficial uses for the waterbodies of the region, including drinking water supply, agricultural water supply, recreation, aquatic habitat, fish migration, and fish spawning. Twenty are applicable to the Salinas River watershed.

The Regional Boards have been given very broad authority to protect water quality under Porter-Cologne, regardless of the source of pollution. The historical focus of the Regional Boards has been on controlling point source pollution, primarily through a system of state and federal permits. Several recent events have put much greater emphasis on nonpoint source pollution and legal requirements related to controlling it. In addition to water quality assessments which indicate nonpoint source impacts, these events include listings of steelhead trout and Coho salmon under the Endangered Species Act along much of the California coast, lawsuits against the Federal Environmental Protection Agency and the State of California for failure to implement provisions of the Clean Water Act related to impaired waterbodies (Total Maximum Daily Loads), and the required statewide upgrade of the Nonpoint Source Program to satisfy requirements of the CZARA.

Development and implementation of Total Maximum Daily Loads (TMDLs) and implementation of the Nonpoint Source Program will be key components of the Regional Board's watershed approach in the future. Waterbodies in the Region which are identified as impaired through water quality assessments are targeted for TMDL development. Implementation of TMDLs in the Salinas River Watershed will focus on greater control of nonpoint source pollution. The Regional Board will work with landowners, local watershed groups, local government and other partners in the development and implementation of TMDLs.

A list and description of Regional Board authority and programs applicable to the Salinas River watershed are included in Appendix A.

California's Watershed Management Initiative

In 1995 the State Water Resources Control Board and Regional Boards conducted an assessment of their effectiveness. The assessment resulted in the Board's Strategic Plan, which recommended, among other things, that Regional Boards begin to look at water quality issues on a larger, more comprehensive watershed scale. As a result, the State adopted the Watershed Management Initiative. Based on establishment of the Watershed Management Initiative, the Regional Board began active development of a more systematic approach to manage nonpoint sources of pollution, even in light of limited staff resources. The framework for determining the need to develop and implement a control strategy for a given nonpoint source pollution problem considers four factors: 1) the magnitude of the problem (through assessment), 2) the presence of

existing institutional and community action, acceptability, and/or willingness to partner in addressing problems (stakeholder involvement), 3) the presence of existing government agencies as potential responsible parties for controlling the problem, and 4) opportunities to coordinate with existing internal staff efforts (e.g., outreach, point source control strategies, monitoring. It became apparent that many regulatory and non-regulatory activities were already underway throughout the Region to address both point and nonpoint sources of pollution.

The Central Coast Regional Board designated the Salinas River watershed as one of its priority watersheds in 1996. A team of staff was formed to manage the traditional programmatic regulatory work in the watershed, including permit writing, enforcement, water quality certifications, and regulation of landfills, underground tanks, and cleanups. In addition, the team's charge was to develop a watershed management plan. The team wrote a two-year, task-oriented strategy (Strategy) to develop a Watershed Management Action Plan. Initial tasks included development of a comprehensive stakeholder list, an inventory describing the agencies, organizations, and groups active in the watershed along with their authority, interests, and current activities, as well as a preliminary assessment of water resource issues within the watershed. In addition to generating the Watershed Management Action Plan, the Strategy's final tasks included an evaluation of water resource issues.

For the past two years, staff has been working on completing the tasks of the Strategy document. To accomplish this effort, staff has taken the approach of participating in water quality and watershed based efforts that were already underway in the watershed with such agencies as Natural Resources Conservation Service, Resource Conservation Districts, University of California Cooperative Extension, the Water Quality Protection Program for the Monterey Bay National Marine Sanctuary, and Monterey County Water Resources Agency. The rationale for such an approach was to capitalize on existing efforts, develop relationships within the watershed, look for opportunities to link on-going efforts so as to preclude duplication of effort, and assess the need for further outreach by the Regional Board. Staff determined that with a more centralized approach to handling of Clean Water Act Section 401 Water Quality Certifications and California Environmental Quality Act (CEQA) review and comment, the Regional Board would be able to obtain a more complete picture of ongoing watershed activities.

Watershed management focuses on development of cooperative relationships within a watershed, with the intent of developing common goals. The challenge for a regulatory agency such as the Regional Board is to balance the time necessary to develop cooperative efforts to improve water quality with legal mandates which the Regional Board must meet. Nonpoint source pollution can only be controlled through widespread implementation of management practices by all land uses. The challenge over the next few years will be to develop better means of tracking implementation of management practices necessary to control nonpoint source pollution and to put into place monitoring and reporting procedures that can assure the Regional Board that regulatory requirements are being met, while preserving the flexibility and self-determination desired by landowners and others.

The watershed management action plan considers ways of incorporating existing regulatory responsibilities of the Regional Board into watershed management, and how to coordinate

Regional Board responsibilities with those of other organizations. The size of the Salinas River watershed and the level and types of activities may make it unique, but many of the agencies, organizations and programs will be the same in other watersheds.

Partners/Watershed Efforts in the Salinas River Watershed

A key component of an effective watershed management approach is developing partnerships. No one agency or individual can accomplish all that needs to be done to protect water resources in a watershed. Collaborative efforts have the most chance of enduring and producing long-term benefits. One of the initial efforts by staff was to compile a list of stakeholders in the watershed and an inventory of the many on-going efforts conducted by other organizations. The Regional Board is currently working with many of these groups whose efforts are focused on resource protection and reduction of nonpoint source pollution. Regional Board involvement includes attendance at meetings, participation on technical advisory committees, presentations at meetings and short-courses, and assistance with funding.

Appendix B contains a summary of several current efforts in the Salinas River watershed with which the Regional Board has involvement. This summary is not meant to be exhaustive, however, because new efforts are continually being initiated throughout the watershed.

Regional Board Watershed Management Activities in the Salinas River Watershed

The principal elements of the Regional Board's watershed approach are devoting additional resources (staff time and grant funding) to watershed activities and increasing Regional Board presence in the watershed through developing partnerships with local governments, resource agencies, citizen groups and landowners. A closely related internal effort will be to integrate existing Regional Board programs and improve internal communication and coordination to increase efficiency and provide better service to both point source dischargers and other constituents in the watershed.

Specifically, the following activities will receive priority in the coming two years:

1. Working with various current and new partners throughout the watershed to encourage development of cooperative projects that support a comprehensive watershed approach, using funding such as Clean Water Act planning and implementation funds;

2. Addressing existing program work such as permitting and inspections through adequate staffing and coordination among staff;

3. Encouraging and supporting expanded offerings and participation in the Ranch Water Quality Planning short courses as well as participating in the development and implementation of similar courses for vineyards and row crops;

4. Working with the State Farm Bureau Federation and the Six County Coalition of Farm Bureaus to implement the Farm Bureau's Nonpoint Source Initiative pilot projects as described in the Monterey Bay National Marine Sanctuary's Plan for Agricultural and Rural Lands;

5. Working as a member of the Sanctuary's Water Quality Protection Program to implement elements of existing plans, such as cross training for agency staff, streamlined permitting for water quality protection projects, and improved coordination between agencies;

6. Encouraging resource planning and the development of resource management plans, such as those promoted by Water Quality Planning short courses and the Central Coast Vineyard Team's positive point system;

7. Evaluating impacts from wine processing facilities and developing recommendations for consistent management;

8. Expanding outreach to cities, counties and urbanized areas regarding the Storm Water Program and upcoming requirements for municipal, industrial and construction storm water permits in conjunction with the Sanctuary's Model Urban Runoff Program;

9. Continuing participation in the Irrigated Agriculture Roundtable, which is sharing information among Regional Boards and working to better define the tiers and options of the Nonpoint Source Program as it relates to irrigated agriculture;

10. Continuing regular (monthly) briefing meetings for staff to share information, coordinate activities, strategize efforts and explore opportunities for streamlining and improved coordination of Regional Board programs (Appendix C lists possible points of discussion);

11. Intensifying efforts with Monterey County Water Resources Agency, other local agencies and partners to implement the action plans for managing nitrate pollution and seawater intrusion in the lower Salinas Valley Ground Water Basin;

12. Improving our understanding of, and initiating action planning for, the potential impacts from highly mineralized geothermal wells located in the Paso Robles Ground Water Basin and making recommendations to modify ground water objectives for the Paso Robles Ground Water Basin as appropriate;

13. Initiating TMDL outreach efforts for the Salinas River and tributaries for sediments, nutrients, pesticides and mercury;

14. Assisting with the development of the Regional Board's Regional Monitoring Program and encouraging widespread use of the data for watershed planning and TMDL development and implementation;

15. Encouraging more comprehensive, watershed-based approaches to issues of flood control, in-stream sand and gravel mining, and land use planning decisions; and

16. Supporting efforts to develop watershed-based approaches through development of coordinated funding efforts.

Milestones

To evaluate the effectiveness of the above activities and better protect water quality, the Regional Board will develop a tracking system for management practice implementation and establish a baseline inventory of currently implemented management practices for each major land use category (row crops, vineyards, rangeland, urban). The baseline information will be used to develop interim targets and timelines for widespread implementation of management practices to support both improved control of nonpoint source pollution and implementation of TMDLs.

The Regional Board will work to develop a prototype of management plans for watersheds or subwatersheds which will allow for flexibility and adequate time for implementation, incorporate monitoring, and satisfy accountability and regulatory reporting requirements through the Nonpoint Source Program.

In addition to the above nonpoint source efforts, the Regional Board will meet all workplan commitments for State Water Resources Control Board programs, including National Pollutant Discharge Elimination System permits and Waste Discharge Requirements.

Reassessment and Future Actions

By the end of fiscal year 2000-2001 (June 30, 2001), the activities described above will have been underway for two years, and milestones developed, giving the Regional Board a better understanding of the level and effectiveness of management practice implementation throughout the watershed. Several more Ranch Water Quality Planning short courses should have been offered as well as pilot courses for the Farm Water Quality Planning short courses, resulting in development and implementation of a number of farm and ranch plans. The Six County Farm Bureau Coalition's pilot project in Salinas should be underway and a protocol for providing information developed. In addition, a sediment TMDL will be developed and implementation begun. Staff will have been meeting on a monthly basis for two years and will have had time to explore the suggestions for improved coordination and streamlining of regulatory activities described in Appendix C.

Following the two year effort, the Regional Board can assess the information available and determine how future effort may be directed. Regional Board staff will evaluate the success of voluntary/self-determined compliance with the Nonpoint Source Management Plan (Tier I) by looking at levels of response, success of the Farm Bureau pilot projects, response to surveys and development of management plans, attendance and participation at short courses, numbers of

plans developed and implemented and whether information on management practices is adequate to assess progress. Regional Board will also assess effectiveness of efforts to improve erosion control, success of internal coordination efforts, and information provided by the Regional Board's Regional Monitoring Program.

Based on the above assessments, the Regional Board will consider whether progress toward improving water resources is adequate or if modification of the watershed management strategy is necessary. If voluntary/self-determined efforts to control nonpoint source pollution appear to be moving forward and participation is increasing, there may be no need for increased regulatory involvement. However, if two years of sustained effort by the Regional Board and its watershed partners does not appear to be increasing implementation of management measures, then other regulatory options may need to be considered. The Regional Board recognizes that improvements to water quality through control of nonpoint source pollution take time and direct water quality improvements cannot always be measured immediately. Therefore, other indicators will be looked at, as described above. The Regional Board has a legal responsibility to protect the waters of the State of California and must be able to show measurable progress toward water quality improvement. Staff will complete the assessments and intends to make further recommendations to the Board by December 2001.

A-3-SLO-97-40
Los Osos Wastewater Treatment Project

APPENDIX A:

COMPARATIVE ANALYSIS OF THE LOS OSOS WASTEWATER TREATMENT PROJECT PROPOSED BY SAN LUIS OBISPO COUNTY AND THE ALTERNATIVE PROPOSED BY THE SOLUTION GROUP

Prepared by:

Central Coast District Office
California Coastal Commission
October 23, 1998

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EXECUTIVE SUMMARY

This document compares the wastewater treatment project proposed by the County of San Luis Obispo with the alternative suggested by the locally based Solution Group. This comparison is intended to assist the Commission in identifying the most appropriate solution to the wastewater management problems faced by the communities of Los Osos, Baywood Park, and Cuesta-by-the Sea, consistent with the San Luis Obispo County certified Local Coastal Program and the California Coastal Act. A summary of the conclusions reached as a result of this process is provided below.

Technical Feasibility

Since the Commission's June 1998 hearing on San Luis Obispo County's coastal development permit application, the Solution Group, in concert with experts in the alternative wastewater treatment method proposed by this Group, has provided convincing information that the proposed alternative may be technically feasible. While it is the position of the Commission staff that the Solution Group alternative may be technically feasible, a definitive conclusion on this issue remains subject to the review of the State and Regional Water Quality Control Boards. As detailed in the Staff Report to which this Appendix accompanies, the State and Regional Water Quality Control Boards have emphasized that approval of the County project, rather than further pursuit of the Solution Group alternative, is the preferable alternative in terms of water quality protection.

Regulatory Compliance

As established by Section 30412 of the Coastal Act, the State and Regional Water Quality Control Boards are the state agencies with the primary responsibility for the coordination and control of water quality; the Coastal Commission is prohibited from taking any action that frustrates this provision. The Solution Group alternative currently does not comply with determinations made by the Central Coast Regional Water Quality Control Board (RWQCB) in matters relating to water quality (e.g., the need to eliminate the use of individual septic systems in the prohibition area established by RWQCB Order 83-13). At this time, therefore, the Commission may not consider the Solution Group proposal a feasible alternative, as further pursuit of this alternative would conflict with Section 30412 of the Coastal Act and LCP Policy 9 for Public Works.

Environmental Impacts

Both the County project and the Solution Group alternative will have adverse impacts on environmentally sensitive habitat areas. As required by the San Luis Obispo County LCP, when such impacts can not be avoided, they must be minimized.

Impacts to sensitive habitats associated with treatment plant construction appear to be generally equivalent for both projects, in terms of the quality of the habitat that would be impacted. Both projects would locate the treatment systems on parcels on which native habitat values have been diminished by exotic invasive vegetation and surrounding land uses. Neither of the treatment plant sites are considered to be important to the long-term conservation of the sensitive species that would be affected. The Solution Group treatment alternative, however, would require more land area than the County treatment

plant, and thereby could have a greater adverse impact on sensitive habitats than the County project in terms of the quantity of sensitive habitat impacted.

With respect to disposal facilities, the Solution Group alternative proposes a reduced service area, which requires a disposal facility that is approximately one-half the size of the disposal facility proposed under the County project, and allows for a proportional reduction in impacts to sensitive habitats. Based on an estimated footprint of 3.5 acres for the County's well facility (please see page 41 of the staff report), impacts to sensitive habitats could be reduced by approximately 1.75 acres under the Solution Group alternative. However, the reduced service area proposed under the Solution Group alternative does not comply with RWQCB Order 83-13, and therefore can not be considered a viable alternative pursuant to Coastal Act Section 30412 and LCP Policy 9 for Public Works.

Pursuit of the Solution Group alternative also has the potential to result in significant delays to the implementation of a wastewater treatment project for the Los Osos area. Any delay or failure in the attempt to eliminate the use of individual septic systems in this area will allow adverse impacts to groundwater and water resources associated with the use of individual septic systems to persist. These impacts include a decline in the health and biological productivity of the Morro Bay National Estuary due to increasing levels of nitrates and bacteria.

The potential for the Solution Group treatment system to result in a larger area of habitat disturbance at the treatment site, and the adverse impacts to marine habitats associated with any further delay to the implementation of a wastewater treatment project, outweigh the environmental benefits of reducing the size of the disposal facilities by 1.75 acres, even if such a reduction complied with RWQCB requirements. As a result, the County project is environmentally preferable, and more consistent with LCP requirements, than the currently proposed Solution Group alternative.

Economic Feasibility

Neither the San Luis Obispo County LCP nor the Coastal Act include treatment works standards allowing for Commission review of the costs of *this* project. (Staff notes that pursuant to Public Resources Code Section 30241e, the Commission may consider the cost of any public service or facility expansion if impacts on the continued viability of agricultural land is an issue. Agriculture is not an issue with this project.) Project costs are only an issue as they relate to the Commission's consideration of alternatives intended to maximize consistency with LCP and Coastal Act requirements; such alternatives must be economically feasible in order to be considered. Thus, the Commission's consideration of economic issues is limited to the question as to whether a preferable alternative, in terms of LCP and Coastal Act conformance, is economically feasible. In this case, the Solution Group alternative is not preferable in terms of LCP and Coastal Act conformance.

Nonetheless, questions and concerns regarding economic issues has been a major source of controversy throughout the history of this project, and have been raised during the Commission review of the County's project. This comparative analysis includes a discussion of the economic issues in order to facilitate a complete and accurate understanding of the economic issues associated with the County project and the Solution Group alternative.

As presented by the project proponents, the County project will have a total cost of approximately $68,068,444, and the Solution Group Alternative will cost $57,732,895. The accuracy of the total cost of the County project has been, and remains, a major source of controversy, notwithstanding the efforts of the Working Group to resolve this issue. The Solution Group estimates that the total cost of the County project is $103,277,525. In Questa Engineering's final evaluation, the cost of the County project was estimated to be $84,224,08, and the cost of the Solution Group alternative was estimated to be $78,182,989. In the opinion of the Commission staff, the cost estimates provided by Questa Engineering represent a reasonably accurate and objective approximation of overall costs for both projects.

Clearly, the implementation of either the Solution Group Alternative or the County Project will be a significant financial strain on the local community. One of the primary ways in which this can be reduced is by securing the $47 million low interest loan currently available from the State Water Resources Control Board. This loan will expire on April 1, 1999 unless construction commences by that time. The County project appears to be in a much better position than the Solution Group alternative to meet this requirement, especially in light of the fact that the project must comply with RWQCB Order 83-13 in order to qualify for this loan.

It is also noted that prior to obtaining final facility design approval form the State Water Resources Control Board, the County project must undergo a final review of its economic feasibility by the State Water Resources Control Board. Impacts to local residents will be considered as part of this analysis.

I. INTRODUCTION

A. Background

The California Coastal Commission is in the process of considering an appeal of the Coastal Development Permit approved by San Luis Obispo County for a wastewater treatment project to serve the communities of Los Osos, Baywood Park, and Cuesta-by-the-Sea. On June 9, 1997, the Coastal Commission determined that the appeal raised a substantial issue, and thereby took jurisdiction of the Coastal Development Permit for this project. De Novo hearings on the project were subsequently continued by the Commission in January and June of 1998.

In its consideration of the coastal development permit application for the wastewater treatment project proposed by San Luis Obispo County, the Commission has identified the need to compare this project proposal with an alternative project proposed by the locally based Solution Group. The intent of this comparison is to identify which project best achieves the objectives and requirements of the San Luis Obispo County certified Local Coastal Program (LCP), and the coastal access and recreation policies of Chapter 3 of the Coastal Act. These requirements are the standard of review that must be applied to the Commission's action on this coastal development permit application, pursuant to Coastal Act Section 30604(b). Section 30412 of the Coastal Act also applies to the Commission's review of this project since it constitutes a "treatment work". The limitations to the Commission's review of treatment work projects established by this Section of the Coastal Act are described on pages 31 – 33 of the accompanying staff report.

To facilitate an independent and comprehensive comparison, staff of the Coastal Commission has worked with representatives from the County of San Luis Obispo, the Solution Group, the Regional Water Quality Control Board, and other interested parties in a forum referred to as the "Los Osos Working Group" (Working Group). Beginning in January, 1998, the Working Group has met numerous times in an effort to define the specific parameters of the comparison, select a consultant with the ability to undertake the comparison, and discuss the conclusions reached by the selected consultant.

On February 4, 1998, the Commission staff released a Request for Proposals to undertake the Comparative Analysis that included a scope of work developed in coordination with the Working Group. On February 26, 1998, the Working Group unanimously selected the proposal submitted by Questa Engineering Corporation (Questa). The San Luis Obispo County Board of Supervisors agreed to fund this study in March 1998, and the County Engineering Department entered into a contract with Questa soon after. A draft report was published by Questa on May 21, 1998, and followed by a public comment period which concluded on May 29, 1998. The final report, which includes the draft report and a response to comments received, was hand delivered at the June 8, 1998 Coastal Commission hearing.

At the June 1998 meeting, the Commission continued the De Novo hearing due to procedural and substantive concerns affecting the Commission's ability to determine the environmentally preferable, feasible alternative. The reduced time frame for responding to the draft analysis, the lack of adequate opportunity for involved parties to review the final document prior to the hearing, and the failure of the consultant to identify the technical problems with the alternative earlier in the process as a "fatal flaw" subject to the review of the working group, were procedural factors resulting in the continuance.

Substantively, the Commission expressed the need to obtain and consider the input of experts more familiar with the treatment method proposed by the Solution Group in order to determine its feasibility. In addition, the need for a more complete analysis of the difference in habitat impacts between the two projects was identified as an important information item necessary to identify the environmentally preferable alternative. Other substantive concerns included the need to have a better understanding of the cost breakdown of the County project, and to further pursue opportunities to avoid impacts to sensitive habitat (i.e., locating the disposal wells in existing roadways). The adequacy of the County's mitigation proposal, particularly with respect to the mitigation of secondary impacts, and whether the mitigation proposal was adequately defined, was another substantive issue raised by the Commission.

Since the June 1998 hearing, the Commission staff has facilitated 4 meetings of the working group in an attempt to resolve these outstanding issues. A primary focus of these meetings was the issue of technical feasibility -- whether the Solution Group proposal could effectively address the water quality problems of the Los Osos area. These discussions delved into the assumptions and methodologies involved in the evaluation of nitrate loading, as well as other technical issues including the handling of algae, sludge, and odor issues. Other issues debated at these meetings, relative to both projects, included economic costs and means of financing, environmental impacts and mitigation measures, and consistency with legal requirements (e.g., California Environmental Quality Act). Written correspondence submitted by Working Group participants since the June 1998 hearing are available by request ath the Commission's Central Coast Office (831-427-4863).

B. Purpose of this Document

This document has been prepared in order to provide the California Coastal Commission with a comprehensive comparison of the environmental, economic, technical, and regulatory issues associated with the wastewater treatment project proposed by the San Luis Obispo County Engineering Department and the locally based Solution Group. More specifically, it supplements the Comparative Analysis previously completed by Questa Engineering (distributed to the Commission at the June 1998 meeting in Santa Barbara) by compiling and analyzing new information developed through subsequent meetings of the Working Group. Overall, this comparison has been provided in order to facilitate a complete understanding, and accurate description of, the two alternative wastewater treatment projects being compared. Specific analysis of the County project's conformance with LCP and Coastal Act requirements is presented in the October 16, 1998 staff report for Coastal Development Permit Application No. A-3-SLO-97-40.

II. UPDATED PROJECT DESCRIPTIONS

A. County Project

The wastewater treatment project currently proposed by the San Luis Obsipo County Engineering Department is generally consistent with the project description provided on pages 3 and 4 of the Draft Comprehensive Comparative Analysis published by Questa on May 21, 1998 (see also, Project Description on pages 28 – 30 of the October 16, 1998 staff report). One correction is that the County proposes 60 gravity wells for effluent disposal at the Broderson site, rather than 46 wells, to ensure that there is adequate disposal capacity during well maintenance and repair.

B. Solution Group Alternative

As discussed at the June 1998 Commission hearing, Questa's report of May 21, 1998 inaccurately described the Solution Group alternative, particularly with respect to the Advanced Integrated Wastewater Treatment System (AIWPS) trademarked by Oswald Green, LLP, proposed under this alternative. Corrections regarding the description and performance of this treatment system have been provided by Dr. William J. Oswald, in his June 25, 1998 comments on Questa's report. A revised site plan for the Solution Group treatment alternative is attached to the staff report as Exhibit 8. While the Questa report identified that the Solution Group treatment system would use approximately 25 acres, the updated site plan submitted by the Solution Group indicates that it would require 31 acres (10.5 acres of which will be landscaped buffer and slope areas).

Another change to the Solution Group alternative is the proposed method of disposing treated wastewater. As previously analyzed by Questa, disposal would take place using three methods: direct discharge to Los Osos Creek; irrigation of golf courses and public open space areas; and, through the use of gravity wells or percolation ponds at the Broderson site. Currently, the Solution Group intends to rely on the use of disposal wells within the existing Highland Avenue roadway, subject to verification that this will not produce daylighting, liquefaction and subsidence downslope from the wells. If the roadway location is not deemed to be feasible, the wells will be located on the Broderson site, contingent, however, upon a similar evaluation of the hazards associated with such a facility. The Solution Group expects that, based upon the reduced service area when compared to the County project, approximately one-half of the number of wells that are

required for the County project would be required for the Solution Group Alternative (i.e., 30 wells).

Finally, it should be clarified that the Solution Group alternative does not currently include the development of multi-family and senior housing, medical offices, a government center, and other public facilities that have been illustrated in the conceptual site plans for this alternative. While such development may be pursued in the future, it is not a component of the current Solution Group proposal.

III. COMPARISON OF ENVIRONMENTAL IMPACTS

While neither the County project nor the Solution Group alternative will completely avoid impacts to environmentally sensitive habitat areas, they differ in the amount of habitat area that will be impacted, and the location of these impacts. The previous comparative analysis completed by the Questa Engineering Corporation did not adequately resolve how these differences compare in terms of complying with the LCP's directive to minimize impacts on sensitive habitat areas.

Impacts to archaeological resources during installation of collection systems can be effectively addressed by permit conditions that will ensure compliance with LCP requirements. Similarly, environmental impacts associated with the disposal of sludge under either project are not expected to be significant or inconsistent with LCP requirements.

Thus, the following analysis focuses on the differences between the impacts to sensitive habitat areas posed by both projects.

A. Comparison of Treatment Plant Impacts

Biological investigations for the County project (i.e., the 1997 SEIR and the 1998 Biological Mitigation Proposal) indicate that the treatment plant will eliminate 6.7 acres of sensitive habitat that consists of 2.9 acres of Dune lupine scrub, 0.7 acres of Heather goldenbrush scrub, and 1.4 acres of Chamise - Wedgeleaf ceanothus chaparral. The remaining 1.7 acres of this habitat area is dominated by the non-native invasive veldt grass. Although veldt grass is not typically considered suitable habitat for sensitive species, it is considered as potential habitat in this case becasue shells of the federally endangered Morro shoulderband snail were found in the veldt. It is not known if the snails inhabited the veldt, or were transported their by predators or other means.

There has not been an equivalently detailed biological investigation of the site on which the Solution group proposes to locate the alternative treatment system. It is estimated that this facility will have an overall footprint of approximately 31 acres, 17 acres of which will be occupied by the wastewater treatment ponds. An additional 3.5 acres of the will be used for other development associated with the treatment system (a septage depot, algal settling ponds and drying beds, filtration systems). The remaining 10.5 acres of the treatment site will primarily be used as detention basins for stormwater runoff, and as playfields when weather/drainage conditions permit. Although the 10.5 acres of detention basin development is not a component of the treatment facility, they are an essential component to locating the facility in this location, which receives large volumes of storm water runoff from surrounding areas.

The Comparative Analysis completed by Questa assumed that the entirety of the Solution Group treatment site provides potential habitat for the Morro shoulderband snail. Thus, Questa concluded that the smaller treatment plant facility proposed by the County is preferable in terms of protecting special status species. This conclusion did not, however, account for the fact that the quality of the habitat on this site has been degraded both by unofficial walking trails and invasive exotic plants such as veldt grass.

In 1992, prior to the listing of the Morro shoulderband snail, an EIR was prepared for a housing development in the same area currently proposed for the Solution group treatment system. As part of this environmental review, two botanical surveys were performed in 1989. The first survey (Exhibit 3) was conducted on a 26.5 acre portion of the site, where construction of the residential units was proposed. This area is approximately 4.5 acres smaller than the entire area that will be required for the Solution Group Treatment System. The second botanical survey (Exhibit 4), evaluated the remaining 28.8 acres of the 55.3 acre site. The additional 4.5 acres needed for the Solution Group treatment system, as well as the 10.5 acres required for the detention basins/playfields, will be located in this area.

According to the first botanical survey, vegetation in the area proposed for the Solution Group treatment system "is or was coastal dune scrub. This has been much disturbed over the years throughout much of the site." While the disturbed nature of this area is emphasized by the survey, it also recognizes that "[s]ince the coastal scrub communities are fast disappearing along the central California coast, the remaining vegetation has increased in value". This botanical report did not quantify the amount of native coastal dune scrub habitat remaining within this 26.5-acre area, but described the lots on which such habitat persists. The Solution Group has extrapolated this information to estimate that 5.5 acres of dune scrub habitat will be impacted by the proposed treatment facilities. In comparison, the County project will impact 5 acres of native dune scrub habitat.

Other native vegetation identified by the 1989 botanical survey is a stand of Coast Live Oak trees, which were recommended for preservation by this report. The Solution Group has stated that the removal of these seven oaks trees would be required to implement this alternative, but that these would be replaced at a 4:1 ratio. The location for these replacement trees is expected to be on a 26.7-acre site adjacent to the treatment site that would be acquired by the Solution Group at some time in the future.

The second botanical survey (Exhibit 4) evaluated areas that will be partly impacted by the 4.5 additional acres of the Solution Group treatment system, as well as by the construction of the proposed playfields/detention basins. The most sensitive habitat area identified by this survey, which supports Sand almond, large areas of Coastal dune scrub, and a willow thicket, will not be impacted by the Solution Group treatment plant or detention basins/playfields. However, an area west of the existing County library that is identified by the survey as having "relatively undisturbed vegetation" may be impacted by the proposed detention basins/playfields. The total extent and quality of the habitat values that will be disturbed by these components of the Solution Group proposal remain unknown.

Another variable in determining the full extent of habitat impacts posed by the Solution Group alternative is the need to ascertain the impact of this alternative on the federally endangered Morro shoulderband snail. As previously noted, the 1992 EIR for this site was written prior to the listing of this species by the U.S. Fish and Wildife Service. The

Solution Group has assumed that habitat for this species is limited to the portions of the site which contain dune scrub habitat (estimated to be 5.5 acres). However, there is the potential that portions of the site degraded by veldt grass or other exotic plants may provide potential habitat for the Morro shoulderband snail, as is the case with the County treatment site.

With respect to the comparative quality of the two treatment proposals, both the County treatment site and the Solution Group treatment site represent degraded habitat areas that are surrounded by land uses that diminish their long-term habitat values. The Draft Recovery Plan for the Morro shoulderband snail prepared by the U.S. Fish and Wildlife Service (USFWS) in 1997 does not identify either the County site or the Solution Group site as a Conservation Planning Area (Exhibit 5). While the County treatment site is in closer proximity to a Conservation Planning Area identified by the Draft Recovery Plan, it is not assigned any sort of conservation designation. The Solution Group treatment site, while being more isolated from Conservation Planning Areas, is designated as an "Other Habitat Area", indicating that it may have some important habitat values, but is not a high priority for acquisition.

In recent discussions, USFWS staff have stated that the Solution Group site is no longer identified as an "Other Habitat Area" in the soon to be released Final Recovery Plan. Based upon these discussions, it appears that neither treatment plant site is considered by USFWS as a high priority for the long-term conservation of the Morro shoulderband snail and other rare native plants, due to the fact that they both represent degraded habitat in close proximity to existing development.

In conclusion, impacts to sensitive habitats associated with treatment plant construction appear to be generally equivalent for both projects, in terms of the quality of the habitat that would be impacted. Both projects would locate the treatment systems on parcels on which native habitat values have been diminished by exotic invasive vegetation and surrounding land uses. Neither of the treatment plant sites are considered to be important to the long-term conservation of the sensitive species that would be affected. The Solution Group treatment alternative, however, would require more land area than the County treatment plant, and thereby could have a greater adverse impact on sensitive habitats than the County project in terms of the quantity of sensitive habitat impacted.

B. Comparison of Effluent Disposal Impacts

Both projects propose to utilize gravity wells for the disposal of treated effluent (although the Solution Group asserts that the use of wells should be dependent upon further investigation of their performance, especially with respect to the potential for the surfacing of effluent downslope of the wells). The County project proposes up to 60 wells on the Broderson site, which, as detailed on page 41 of the staff report, will impact approximately 3.5 acres of this 80-acre site.

The Solution Group has indicated its intention to locate the disposal wells in the existing roadway rights-of-way adjacent to the Broderson site, if feasible. If this is not feasible, the Solution Group will locate the wells on the Broderson site. As discussed on page 38 of the staff report, locating the wells within existing roadways has been determined to be infeasible. Thus, it is expected that the Solution Group proposal will also involve the installation of disposal wells on the Broderson site.

According to the Solution Group, a maximum of 29 wells would be required for their alternative, due to the smaller size of the service area. This would result in a well field of approximately one half the size of the well field required for the County project, that would have an impact area of approximately 1.75 acres.

The Broderson site, which is at the southern edge of the urbanized area of Los Osos, is recognized as containing significant environmental resources including Chaparral, Coastal Scrub, and Live Oak Woodland habitats. Special status plant and animal species that are expected to occur on the site include: Blochman Leafy Daisy, Indian Knob Mountainbalm, San Luis Obispo Wallflower, Morro Manzanita, Sand Almond, Morro Bay Kangaroo Rat, Morro Shoulderband Dune Snail, Morro Blue Butterfly, Monarch Butterfly, Black Legless Lizard, and California Spotted Owl. In recognition of these habitat values, the Broderson site has been proposed as a "Conservation Planning Area" by U.S. Fish and Wildlife Service's Draft Recovery Plan for the Morro Shoulderband Snail and Four Plants (Morro Manzanita, Chorro Creek Bog Thistle, Indian Knob Mountainbalm, and Pismo Clarkia) from San Luis Obispo County.

A reduction in the amount of land that is required for effluent disposal facilities on the Broderson site would clearly be preferable in terms of complying with the LCP's directive to minimize impacts on environmentally sensitive habitats. In this case, however, the 1.75-acre reduction that would be realized by the Solution Group alternative is a result of a reduced service area that conflicts with RWQCB Order 83-13. As previously noted, this eliminates the Solution Group proposal as an alternative to be considered by the Commission pursuant to Coastal Act 30412.

In addition, the Comparative Analysis completed by Questa questioned the feasibility of utilizing wells for the Solution Group alternative, due to the quality of effluent expected from the proposed treatment system, which could increase risks of the wells becoming clogged. In on-going discussions with the working group, and based on the information provided by experts in the technology proposed by the Solution Group, it appears that the Solution Group treatment system may be able to achieve a treated effluent quality that would allow for the use of disposal wells. This assumption would be subject to future review by wastewater experts and the appropriate regulatory agencies. Should such a review conclude that the use of disposal wells is not compatible with the treatment system proposed by the Solution Group, it is expected that the Solution Group alternative would need to revert to percolation ponds for effluent disposal. Such a scenario would increase adverse impacts to sensitive habitats at the Broderson site beyond the impacts that will result from implementation of the County project.

C. Comparison of Mitigation Proposals

Both the County project and the Solution Group alternative will result in adverse impacts to environmentally sensitive habitat areas. As a result, the way in which these impacts will be mitigated is of critical importance in achieving compliance with LCP standards requiring that the biological productivity of sensitive habitat areas be maintained. At this point in time, the biological mitigation measures proposed by both the County and the Solution Group suffer from a lack of specificity, and the absence of USFWS consultation pursuant to the Endangered Species Act. While this might be expected of the Solution Group alternative, which is a relatively new proposal that does not have access to public funding, it makes the review of a coastal development permit for the County project more

difficult. A description of the County mitigation proposal, and an analysis of its compliance with LCP policies, is provided on pages 45-51 of the accompanying staff report.

Overall, the County's biological mitigation proposal includes the restoration and preservation of portions of the treatment plant and disposal sites that will not be required for project facilities. At the treatment plant site, this equates to preservation/restoration of approximately 3.7 acres of dune scrub habitat. At the disposal site, approximately 76.5 acres will be preserved/restored. About 10.5 acres of this area will be preserved and restored as coastal scrub habitat, and the remaining 66 acres will be preserved as Coastal live oak and Manzanita habitat. In addition, the County proposes to purchase land having at least 40 acres of good coastal scrub habitat. Due to the sensitive nature of land negotiations, the County has not identified potential sites for this purchase. The mitigation proposal, however, does state that the 40 acres would be composed of large parcels, in good habitat condition, and contiguous with other open space areas. The County proposal states that all candidate parcels are within areas designated for protection by the Draft Recovery Plan for the Morro shoulderband snail.

As proposed by the Solution Group, the 5.5 acres of coastal dune scrub habitat that will be lost as a result of the proposed wastewater treatment system will be mitigated by the protection of an equivalent habitat area. Options to carry out this measure include: revegetating and protecting portions of the treatment site that will not be impacted by the treatment system; or, acquiring, revegetating and protecting 5.5 acres of coastal dune scrub habitat either on a 26.7 acre parcel adjacent to the treatment site or on another site acquired to mitigate impacts at the disposal site (discussed below).

The type of biological mitigation that will be provided by the Solution Group to compensate for habitat impacts of the disposal facilities is dependent upon whether the disposal wells are located in existing roadway rights-of-way, or on the Broderson site. If the wells can be located in existing roadways (the preferred option), then the Solution Group would the purchase and preserve the northern 100 acre portion of the Morro Palisades site, adjacent to the eastern boundary of the Broderson site. If the wells must be located on the Broderson site, then the biological mitigation would be generally equivalent to that offered under the County project: preservation and restoration of the portions of Broderson site that will not be impacted by disposal facilities (approximately 78.25 acres as compared to 76.5 acres under the County project); and, the acquisition and protection of an appropriate 40 acre mitigation site.

As previously noted, and as discussed on page 38 of the staff report, locating the wells within existing roadways has been determined to be infeasible. Thus, the mitigation proposal offered by the Solution Group is generally equivalent to the mitigation proposal put forth by San Luis Obispo County.

D. Other Environmental Considerations - Length of Time Required to Implement Project Alternatives

The relatively small decrease in terrestrial habitat impacts (approximately 1.75 acres) at the Broderson site that could result under the Solution Group alternative needs to be considered in context with ongoing impacts to sensitive aquatic habitats associated with the continued use of individual septic systems (e.g., shellfish beds that have been closed due to excessive bacteria levels). Further pursuit of the Solution Group alternative has

the potential to result in significant delays to the implementation of a solution to this problem, and poses risks to the ability to implement a solution at all.

Potential time delays associated with the Solution Group alternative include, but may not be limited to:

- The need to condemn the proposed treatment site because the property owner is an unwilling seller;
- The need to conduct biological investigations of the treatment site;
- The need to obtain voter approval for a revised assessment district;
- The need to conduct additional environmental review for the revised service area and method of treatment pursuant to the California Environmental Quality Act; and,
- The need to develop engineered plans and obtain RWQCB approval of these plans.

Potential risks to the implementation of a solution to the region's water quality problems associated with the Solution Group alternative include, but may not be limited to:

- The fact that the $47 million dollar loan from the State Water Resources Control Board will expire in April 1999 if construction does not commence by that time, and that this loan can only be applied to projects that have been reviewed and approved by the RWQCB; and
- The fact that a revised assessment district could be denied by a vote of the affected residents.

E. Conclusion

As currently proposed, the Solution Group alternative is inferior to the County project in terms of protecting environmentally sensitive habitat areas. With respect to the impacts of the two treatment proposals, the quantity of sensitive habitat area that will be impacted by the Solution Group treatment system exceeds that which will be impacted by the County treatment plant. The quality of the habitat on either treatment site is generally equivalent; both represent degraded native habitat areas surrounded by urban uses that are not a component of long-term efforts to protect environmentally sensitive habitats. In terms of habitat impacts associated with the disposal of treated effluent, the Solution Group alternative offers an opportunity to reduce such impacts by approximately 1.75 acres. This, however, is a result of a reduced service are which conflicts with RWQCB Order 83-13, and, as a result, with Coastal Act Section 30412 as well. Furthermore, the relatively small reduction in habitat impacts at the disposal site is outweighed by the fact that pursuit of the Solution Group alternative would delay implementation of a solution to the areas water resource problems, and put at risk the ability to implement a solution. This would allow adverse impacts to sensitive aquatic habitats resulting from the continued use of individual septic systems to persist and perhaps increase.

IV. TECHNICAL ISSUES

To ensure that LCP policies calling for the protection of water resources are effectively achieved, the Comparative Analysis of the County project and the Solution Group alternative completed by Questa evaluated which of these proposals would best achieve water quality objectives. Questa's analysis concluded that the County Plan provides far more assurance of the ability to correct the existing groundwater nitrate problem than is offered by the Community Plan (i.e., the Solution Group Alternative).

As presented at the Commission hearing of June 8, 1998, the primary factor leading to this conclusion was that the level of wastewater treatment expected to be realized through the Solution Group treatment system was found to be unrealistic. While the Solution Group had expected that treated effluent would have a concentration of 3 mg/L of nitrogen, the wastewater engineers comparing the two projects believe that a nitrogen concentration ranging between 8 and 12 mg/L would be more likely. In addition, Questa's analysis also identified that even if a nitrogen concentration of 3 mg/L in the treated wastewater could be consistently realized under the Solution Group alternative, the RWQCB's objective of reducing nitrate levels throughout the groundwater basin to 7 mg/L would not be realized. This is due to the larger area of the Community that would remain on septic systems when compared to the County project. In comparison, the report states that the County project will be able to achieve this objective in 17 to 30 years. Other aspects of the Solution Group alternative identified by the Draft Comparative Analysis published by Questa in May 1998, which in Questa's opinion made it inferior to the County project in terms of protecting water resources, included:

- The proposed treatment system is susceptible to uncontrollable process imbalances (e.g. cloudy days which limit photosynthesis, windy conditions which turnover pond contents, and seasonal shifts in algal species) that can reduce the ability to remove nitrogen;

- areas where septic systems are retained would result in "plumes" of groundwater with nitrogen concentrations in excess of 10 mg/L, the drinking water limit, and poses greater risks of groundwater contamination from bacteria and other pathogens; and,

- the proposed recharge of the deep aquifer via Los Osos creek would have the undesirable affect of introducing relatively high loads of total dissolved solids (TDS) directly into the aquifer from which Los Osos obtains its drinking water.

Questa's Draft Comparative Analysis also identified elements of the Solution Group Plan which raised serious questions regarding its technical feasibility, and its ability to comply with water quality regulations. These included:

- unresolved issues regarding the handling and disposition of coagulated biosolids that result from the proposed treatment process; and

- the quality of the treated wastewater would be unlikely to meet requirements that would allow for its use as irrigation water or for disposal to Los Osos Creek.

Questa's Draft Comparative Analysis noted that there are clear advantages to the use of the AIWPS in rural settings where land area is not a constraint and where the treated wastewater can be used for irrigation (e.g., St. Helena, Hollister, Bolinas). However, it concluded that the over-riding demand to comply with strict nitrogen removal requirements and to produce tertiary level effluent quality for groundwater recharge and/or reuse make the AIWPS an inappropriate choice for the Los Osos situation.

Since the June 8, 1998 Commission meeting, the Working Group has discussed the above issues at great length. The Solution Group, in concert with professional engineers that are intimately familiar with the proposed treatment system, has responded to the large majority of the issues identified by the Questa report (correspondence available on request). This new information has provided substantial evidence that, in the opinion of the Commission staff, generally supports the Solution Group's proposal as a technically feasible alternative to the County project.

One important technical issue that remains unresolved with respect to the Solution Group alternative's ability to achieve water quality objectives is whether the reduced service area proposed under this alternative will adequately eliminate sources of nitrates to groundwater and surface water resources. Approximately 44% of the community will remain on septic systems under the Solution Group alternative, while 14% would remain on septic systems under the County project. The Working Group spent a significant amount of time debating this issue and was unable to reach consensus. Resolution of this issue would need to take place through further review of the Solution Group alternative by the State Water Resources Control Board and the Central Coast RWQCB, as further discussed below.

V. REGULATORY COMPLIANCE

Currently, the wastewater treatment service area proposed by the Solution Group does not comply with RWQCB Order 83-13, which establishes a prohibition against septic system discharges in specific areas of the Community. As a result of this conflict, the Solution Group alternative is not an option that can be pursued by the Commission pursuant to Coastal Act Section 30412 and LCP Policy 9 for Public Works. This issue, and its implications upon the Commission's review, is discussed in more detail on pages 31 – 33 of the staff report that accompanies this document.

It is recognized, however, that the County has been able to negotiate a revision to the prohibition boundary originally established by RWQCB Order 83-13. This revision was based on the implementation of a Septic System Management Plan in geographic regions typified by parcels larger than one acre in size (i.e., the 14% area of the community that will remain on septic systems under the County project). The opportunity for a further reduction in the prohibition area, as would be necessary to implement the Solution Group alternative, does not appear likely. This is due to the fact that many of the parcels that would remain on septic systems under the Solution Group alternative do not meet RWQCB requirements for on-site septic systems (please see Exhibit 9 attached to the staff report). Overall, the State Water Resources Control Board and the RWQCB have emphasized their position that approval of the County project, rather than further pursuit of the Solution Group alternative, is the preferred action in terms of water quality protection.

VI. ECONOMIC FEASIBILITY

As previously noted, neither the San Luis Obispo County LCP nor the Coastal Act include treatment works standards allowing for Commission review of the costs of this project. Project costs are only an issue as they relate to the Commission's consideration of alternatives intended to maximize consistency with LCP and Coastal Act requirements; such alternatives must be economically feasible in order to be considered. Thus, the Commission's consideration of economic issues is limited to the question as to whether a preferable alternative, in terms of LCP and Coastal Act conformance, is economically feasible. In this case, the Solution Group alternative is not preferable in terms of LCP and Coastal Act conformance.

Nonetheless, questions and concerns regarding economic issues has been a major source of controversy throughout the history of this project, and have been raised during the Commission review of the County's project. This comparative analysis includes a discussion of the economic issues in order facilitate a complete and accurate understanding of the economic issues associated with the County project and the Solution Group alternative.

As presented by the project proponents, the County project will have a total cost of approximately $68,068,444, and the Solution Group Alternative will cost $57,732,895. The accuracy of the total cost of the County project has been, and remains, a major source of controversy, notwithstanding the efforts of the Working Group to resolve this issue. The Solution Group estimates that the total cost of the County project is $103,277,525. In Questa Engineering's final evaluation, the total cost of the County project was estimated to be $84,224,08, and the cost of the Solution Group alternative was estimated to be $78,182,989. In the opinion of the Commission staff, the final cost estimates provided in Questa Engineering's June 5, 1998 Response to Comments represent a reasonably accurate and objective approximation of overall costs for both projects.

To determine the capital cost of the County project, Questa reviewed the Modified Engineer's Report (as revised in June 1997), which provides a detailed cost estimate for the project. This report was an essential component to the formation of the assessment district required to finance the project. As presented by this report, cost estimates were divided into two principal catagories: pre-construction costs and construction costs.

Pre-construction costs, which include general project costs, assessment district costs, property acquisition/rights-of-way, and pump discount, have been calculated by the County to be $14,432,444. An additional financing cost of $6,188,000 was estimated by the County, but subsequently reduced to $3,655,484 (a reduction of $2,532,516) by the County's bond underwriter. According to the Questa report, this difference stems from lower reserve and bond insurance costs in the underwriter's estimate.

Construction costs for the County project included: the construction of collection, treatment, and disposal facilities; contingencies; construction management; and environmental monitoring. The County calculated these costs at $47,636,000.

Taken together, pre-construction and construction costs for the County project are $68,068,444 as calculated by the County, and $65,535,928 with the reduced financing cost estimated by the underwriter. These are capital costs only; one-time sewer

connection costs would are the responsibility of the property owner. The County has estimated that individual connection costs would be approximately $850. Local residents assert that these costs would range from $4,000 to $5,000 per connection. The economic analysis contained in the Questa Report estimated that individual connections would have an average cost of $2,500. Questa's analysis included the cost of financing this expense within the overall project cost estimate.

In addition to capital and connection costs, the Questa report estimated the operations and maintenance costs of the County project. These costs, which cover the operation and maintenance of the tertiary level treatment plant, gravity disposal wells, effluent force mains, and Septic System Management Program was estimated to be $1,176,745. Extended over a 30 year period, with an annual discount rate of 4%, the present value of of a 30 year period operation and maintenance costs was estimated to be $20,348,314. Extended over a 50-year term, the Questa Report estimated the present value for the operations and maintenance costs to be $25,279,053.

A similar approach was taken in the Questa Report's analysis of the overall cost of the Solution Group project. This analysis identified numerous project costs that had not been included in the Solution Group's original estimations. As presented in Questa's final analysis, the capital costs for the Solution Group alternative (i.e., pre-construction and construction cost, including sewer system connections) were estimated to be $40,557,768. Annual operations and maintenance costs were estimated to be $1,863,160, which translates to a present value cost of $31,928,425 over a 30-year period, and $39,665,221 over a 50-year period.

Total project costs over a 50-year period, as estimated by the Questa report are $84,224,081 for the County project and $78,182,989 for the Solution Group Alternative. The Questa report notes that the total project cost for the Solution Group alternative are the minimum costs associated with this proposal, and that financing and assessment district costs remain an issue.

The Solution Group has challenged the cost estimates contained in the Questa Report, and countered that total capital costs would be $37,823,527. The most significant difference is in the estimation of operation and maintenance costs. The Solution Group estimates that total operations and maintenance costs would be $908,165 annually, and $19,509,368 over a 50 year period, for a total project cost of $57,332,895 over a 50 year project life.

Regardless of which cost estimates are the most accurate, the implementation of either the Solution Group Alternative or the County Project will clearly have a significant economic impact on the local community. One of the primary ways in which this can be reduced is by securing the $47 million low interest loan currently available from the State Water Resources Control Board. This loan will expire on April 1, 1999 unless construction commences by that time. The County project appears to be in a much better position than the Solution Group alternative to meet this requirement, especially in light of the fact that the project must comply with RWQCB Order 83-13 in order to qualify for this loan.

It is also noted that prior to obtaining final facility design approval form the State Water Resources Control Board, the County project must undergo a final review of its

economic feasibility by the State Water Resources Control Board. Impacts to local residents will be considered as part of this analysis.

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Study Finds Methane Emissions from Septic Systems Lower than Previous Estimates

Findings from a recently completed WERF research study show that greenhouse gas (GHG) emissions from septic tanks may be significantly lower than previous estimates. The project, *Evaluation of Greenhouse Gas Emissions from Septic Systems* (DEC1R09), found that emission rates for methane were roughly half of current estimates outlined under the Intergovernmental Panel on Climate Change's (IPPC's) Guidelines for National Greenhouse Gas Inventories.

View the Report

Evaluation of Greenhouse Gas Emissions from Septic Systems (DEC1R09)

Although the wastewater sector is not a major source of GHG emissions, the project's findings are of significant interest to the wastewater treatment community. Prior estimates by the U.S. Environmental Protection Agency, which relied on assumptions under the IPPC's GHG inventories, suggest that 80 percent of the wastewater sector's methane emissions are from septic systems. However, the IPPC methodology assumes that all wastewater carbon in anaerobic systems converts to methane, and that all methane produced enters the atmosphere. This runs counter to prior findings on GHG emissions from septic systems, leaving the actual levels of methane production in question.

This research effort, led by a team from the University of California-Davis, collected more accurate data on GHG emissions from septic tank systems, focusing on methane emissions from conventional septic tanks. Researchers collected gas samples using flux chambers to capture gases from the tank contents, and applied field methods to determine the rate of GHG emission rates from tanks, vents, and soil dispersal systems. Greenhouse gases, methane and carbon dioxide, were found in emissions from the septic tank, while carbon dioxide and nitrous oxide were observed in the system vents but not above ground through the soil dispersal system.

The CO2 equivalent GHG emission rates from septic tank systems (see table below) were determined using either the flux chamber or mass balance methods and were found to be relatively low compared to U.S. EPA estimates for a citizen of an industrialized country (about 23.2 ton CO2e/capita•year).

The project, which collected thousands of data points, is the largest study to date of GHG emissions from septic systems. Although these findings are significant, they are not new. The project uncovered literature that is consistent to the U.C. Davis study, some of it going back to as early as 1910. For more information on this project, contact WERF Program Director Lauren Fillmore.

Appendix K:
Air Quality

Table 5.9-14 (Cont.): Construction GHG Emissions

System/Source	Metric Tons CO_2e per year			
	Project 1	Project 2	Project 3	Project 4
Conveyance				
On road vehicular	361,361	363,495	363,495	393,944
Off road equipment	63	63	63	83
Conveyance Total	**361,424**	**363,558**	**363,558**	**394,027**
Treatment				
On road vehicular	490,602	492,661	492,661	490,478
Off road equipment	519	446	446	519
Construction materials off-site	2,115	3,043	3,043	3,095
Treatment Total	**493,236**	**496,150**	**496,150**	**494,092**
Disposal				
On road vehicular	981,492	981,809	981,809	981,928
Off road equipment	838	838	838	838
Disposal Total	**982,330**	**982,647**	**982,647**	**982,766**
GRAND TOTAL	**4,320,493**	**3,712,167**	**3,712,167**	**3,740,731**
Source: MBA 2008.				

Long-term Operational Impacts

Long-term operational GHG emissions for the collection system for Proposed Project 1 would come from on-road motor vehicle, energy usage, and the regular transfer of septage from septic tanks to the treatment plant by tanker truck.

On-road motor vehicle activity during continuous operation of the facility includes employee commute, maintenance trips, and septage hauling for Proposed Project 1. Estimates of GHG emissions from purchased and consumed electricity for the operation of the collection system were provided by Carollo Engineering (Carollo 2008b). GHG estimates from the operation of the collection system pump stations are based on the total annual energy demand. The annual energy demands were estimated for the collection pipelines and the pump stations for Proposed Project 1. Emission factors were from the CCAR's General Reporting Protocol (CCAR 2008).

Also included in the long-term operations of the collection system for Proposed Project 1 is the methane emissions from septic tank venting. Methane emissions are generated from the anaerobic biodegradation of domestic wastewater within septic tanks and are vented to the atmosphere, contributing to the total carbon footprint calculated for Proposed Project 1. Estimates of the annual methane emissions vented from septic tanks are included for the prohibition zone only at build-out. The approach used for calculating septic tank methane emissions are established in the 2006 IPCC

Guidelines for National GHG Inventories which is followed by the EPA as related by Carollo Engineering (Carollo 2008b).

Table 5.9-15 shows long-term operational GHG emissions associated with the proposed collection system of Proposed Project 1. As shown in Table 5.9-15, the total long-term GHG emissions associated with Proposed Project 1 would result in a net reduction of GHG emissions compared to the existing wastewater collection system. The implementation of the collection system under Proposed Project 1 would contribute to the annual reduction in GHG emissions. Therefore, GHG emissions associated with the operation of the collection system of Proposed Project 1 would not hinder or delay the State's ability to achieve the year 2020 goals of AB 32. The operation of the proposed collection system under Proposed Project 1 would contribute a net reduction in GHG emissions, thus, the operation of the proposed collection system would contribute to a beneficial impact on GHG emissions.

Table 5.9-15: Operational GHG Emissions

System/Source	Metric Tons CO_2e per year			
	Project 1	Project 2	Project 3	Project 4
Collection				
On road vehicular	98,564	69,668	69,668	69,668
Energy usage	169	199	199	199
Septic tanks	624	0	0	0
Collection Total	**99,357**	**69,867**	**69,867**	**69,867**
Conveyance				
On road vehicular	20,945	20,945	20,945	20,945
Conveyance Total	**20,945**	**20,945**	**20,945**	**20,945**
Treatment				
On road vehicular	53,148	80,605	80,605	52,500
Energy Usage	425	541	541	493
Chemical Production off-site	356	14	14	356
Treatment Total	**53,929**	**81,159**	**81,159**	**53,349**
Disposal				
On road vehicular	0	0	0	0
Disposal Total	**0**	**0**	**0**	**0**
GRAND TOTAL	**174,231**	**171,971**	**171,971**	**144,161**
Current Operations	201,045	201,045	201,045	201,045
NET DIFFERENCE	**-27,654**	**-29,914**	**-29,914**	**-57,724**
Percent Reduction	*15.9%*	*17.4%*	*17.4%*	*40.0%*
Source: MBA 2008.				

Cumulative Impact Analysis

Related projects within the greater cumulative project area are detailed in Section 4.2 and Exhibit 4.2-1 in the Draft EIR. Three of the nine related projects (Los Osos CSD Waterline Replacement, Los Osos Valley Road Palisades Storm Drain, and AT&T Cable) physically overlap with the study area for the proposed project but are either completed or expected to be completed by the time construction of the proposed project is anticipated to begin (2010). Six of the nine related projects (State Park Marina Renovation, Morro Bay Wastewater Treatment Plant, Dredging of Morro Bay, CMC Wastewater Treatment Plant, Phase II Steam Generator Replacement at Diablo, and Spent Fuel Storage Facility at Diablo) have no physical overlap with the proposed project; however, they could contribute to GHG impacts. Since Proposed Projects 1 through 4 could reduce GHG emissions compared to the existing wastewater system, implementation of any of the proposed projects would not contribute to an adverse cumulative impact related to GHG emissions.

Mitigation Measures

Project-Specific

Proposed Projects 1 through 4

No mitigation measures are required.

Cumulative

Proposed Projects 1 through 4

No mitigation measures are required.

Level of Significance After Mitigation

Project-Specific

Proposed Projects 1 through 4

Less than significant.

Cumulative

Proposed Projects 1 through 4

Less than significant.

Conflict with Local Goals and Policies

5.9-G:	The project would not conflict with local goals and policies in the General Plan.

Project-Specific Impact Analysis

The County of San Luis Obispo does not have any air quality goals or policies in the current adopted General Plan that are relevant to Proposed Projects 1 through 4. Therefore, Proposed Projects 1 through 4 would not impact any County General Plan air quality goals or policies.

Cumulative Impact Analysis

Since Proposed Projects 1 through 4 would not impact currently adopted General Plan air quality goals or policies, Proposed Projects 1 through 4 would not contribute to cumulative impacts on air quality goals or policies.