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STAFF REPORT: REGULAR CALENDAR

Application No.:	**1-12-023**
Applicant:	**Dale and Lei Winget**
Agent:	LACO Associates
Location:	254 Roundhouse Creek Road, approximately 4.5 miles north of the City of Trinidad in the Big Lagoon area of Humboldt County (APN 517-251-018).
Project Description:	(1) Develop a 0.33-acre vacant, undeveloped bluff-top lot with a new ~1,200-square-foot, one-story, single-family residence, gravel driveway and parking area, on-site sewage disposal system, water line, drainage swale, and landscaping; and (2) remove approximately 22 Sitka spruce trees.
Staff Recommendation:	Approval with conditions.

SUMMARY OF STAFF RECOMMENDATION

The Applicants propose to develop a 0.33-acre vacant, undeveloped lot with a new ~1,200-square-foot single-family residence and on-site sewage disposal system and to remove approximately 22 relatively young Sitka spruce trees. The subject property is located in the Big Lagoon Estates Subdivision of northern Humboldt County (**Exhibits 1-3**). The property is

located in a partially developed residential neighborhood on an uplifted marine terrace at an elevation of approximately 125 feet above mean sea level. The Big Lagoon Estates Subdivision has been subject to extraordinary rates of bluff retreat in the past. The subdivision lies on a bluff composed of poorly consolidated terrace sands, where the bedrock layer (Franciscan formation) lies below sea level. Rapid rates of bluff erosion have been measured from aerial photographs for the 1930s (58 feet of bluff retreat in a decade), winter 1941/1942 (30 feet in a season), 1980s (at least 55 feet), and winter 1997/1998 (60 feet in a season). These sudden episodes of catastrophic bluff failure have led to emergency relocations of homes on several occasions, including an emergency house relocation from the lot immediately adjacent to the subject site to the southwest in January of 1999; an emergency house relocation ~300 feet north of the subject site in September of 1999; and an emergency house relocation from ~200 feet south of the subject site in 2003 (see **Exhibits 4 and 5** depicting home relocation sites relative to the subject site). In addition, 28 cabins located in the Big Lagoon Park community, located less than one half-mile north of the subject property, have had to be relocated over the years due to episodic retreat events.

In order to assure consistency with Coastal Act Section 30253, staff recommends the Commission find that a setback of 189 feet is required and that a bluff retreat rate of 1.5ft/year should be utilized to estimate future bluff retreat. This rate is consistent with the higher end (though not highest) of bluff retreat rates that have been estimated for the subject bluff and would best assure that the residence is sited in a location that accounts for bluff retreat as exacerbated by sea level rise effects. The new home is instead proposed to be located a minimum of 151 feet from the bluff edge. Assuming a bluff retreat rate of 1.5 feet per year to account for the effects of bluff retreat as exacerbated by future sea level rise, the Applicants' proposed setback distance of 151 feet from the bluff edge only would assure stability and structural integrity for 50 years, which is less than the 75 year lifespan of the proposed new residence identified in the Applicant's geologic plans and reports. Thus, rather than assure structural stability and structural integrity in a manner that accounts for bluff retreat as exacerbated by sea level rise, the Applicants' proposed new residence instead assures that at some point in its lifespan it will be subject to a factor of safety less than 1.5.

When an applicant demonstrates they will construct development with an adequate setback to assure stability and structural integrity without protective devices, the Commission often secures their compliance by imposing a no future seawall condition requiring the owner to acknowledge that: (1) they have no right to build a future shoreline protective device to protect the approved development; and (2) must remove the structure when the bluff recedes to within 10 feet of the structure so as to ensure safe access for remedial measures. Here, however, the Applicants have not demonstrated a sufficient setback to assure consistency with Section 30253. Staff nevertheless recommends that the Commission allow some limited development, even though a Coastal Act policy would otherwise prohibit it because Section 30010 the Coastal Act requires that the Coastal Act shall not be construed in a manner that will take private property for public use.

The inland boundary line of the subject property lies approximately 185-195 feet from the bluff edge, so it is not possible to site any significant amount of development on the property at least 189 feet from the bluff edge in a location that accounts for bluff retreat as exacerbated by sea

level rise effects. A denial of this residence would effectively be a denial of any other redesign of the project and likely constitute a categorical regulatory taking of the applicant's property, since there is no design that will satisfy all Coastal Act concerns. *Lucas v. South Carolina Coastal Council* (1992) 505 U.S. 1003. Therefore, staff recommends a limited approval of the proposed development, thereby shifting the constitutional analysis from the categorical prohibition on denial of all economic use contained in *Lucas* to the balancing test found in *Penn Central Transportation Co. v. City of New York* (1978) 438 U.S. 104. Recognizing that the balancing test in *Penn Central* includes an assessment of the owner's reasonable investment-backed expectations, staff recommends that the Commission find that: (1) the Applicants could reasonably expect to develop this property with a house only as long as the bluff was stable enough to support it; and (2) the development of the lot as conditioned to require removal and/or relocation of the house when the bluff is not stable enough to support it comports with *Penn Central* and Section 30010 of the Coastal Act.

Staff believes that although the Applicants have certain reasonable investment-backed expectations, the Commission could deny a request by a future purchaser to develop this property contrary to the terms and conditions of this permit if the conditions were recorded against the property and the purchaser was notified in advance of their purchase of the limitations on development of the property. Requiring that the limitations on development of this property become part of the title to this property would prevent subsequent purchasers from acquiring a right to develop the property in a manner contrary to those limitations.

Accordingly, staff recommends a special condition that requires prospective purchasers be notified of the terms and conditions of this permit, including but not limited to the requirements that: (1) the single family residence cannot be set back far enough to assure structural stability for its lifespan; (2) shoreline protective device(s), including but not limited to seawalls, revetments, upper bluff retaining walls, and caissons, are prohibited to protect the development authorized by CDP 1-12-023, and the approved structure will not be considered to be an existing structure for purposes of Coastal Act Section 30235; and (3) the single family residence authorized by CDP 1-12-023 must conform to the Applicants' geologist's recommendations and be constructed of a foundation system that facilitates moving the structure and its foundation in the future when either any government agency orders removal or when the bluff becomes unstable as determined by required monitoring.

As conditioned to require that all development be sited entirely within the surveyed building envelope (**Special Condition 1**), that the Applicants agree to remove the approved development when any agency orders its removal or when the bluff becomes unstable as determined by required monitoring (**Special Conditions 2, 3, 4**), and other specific mitigation measures to further minimize geologic hazards as discussed below and in **Special Conditions 5-8**, Commission staff believes that the project, as conditioned, will mitigate all significant adverse environmental effects and geologic hazards to the greatest extent feasible while providing for a reasonable use of the property that will avoid an unconstitutional taking of private property consistent with Coastal Act Section 30010.

The motion to adopt the staff recommendation of approval with special conditions is found on page 4.

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APPENDICES

EXHIBITS

I. MOTION AND RESOLUTION

The staff recommends that the Commission adopt the following resolution:

Motion:

I move that the Commission approve coastal development permit 1-12-023 pursuant to the staff recommendation.

Staff recommends a **YES** vote on the foregoing motion. Passage of this motion will result in approval of the 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:

The Commission hereby approves coastal development permit 1-12-023 and adopts the findings set forth below on grounds that the development as conditioned will be in conformity with the policies of Chapter 3 of the Coastal Act and will not prejudice the ability of the local government having jurisdiction over the area to prepare a Local Coastal Program conforming to the provisions of Chapter 3. Approval of the 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 development on the environment, or 2) there are no further feasible mitigation measures or alternatives that would substantially lessen any significant adverse impacts of the development on the environment.

II. STANDARD CONDITIONS

This permit is granted subject to the following 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**: If development has not commenced, the permit will expire two years from the date on which the Commission voted on the application. Development shall be pursued in a diligent manner and completed in a reasonable amount of time. Application for extension of the permit must be made prior to the expiration date.

3. **Interpretation**: Any questions of intent of 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.

III. SPECIAL CONDITIONS

This permit is granted subject to the following special conditions:

1. Conformance of Final Design and Construction Plans to the Geologic Reports.

a. All final design and construction plans, including site preparation, cut and fill slopes, fill materials, compaction, seismic design, setbacks, foundation design, drainage and erosion control, and septic design, shall be consistent with the recommendations contained in the geologic reports titled (1) "*Geotechnical Report, New Single-Family Residence, 254 Roundhouse Creek Road, Big Lagoon, California*" dated December 16, 2011, prepared by LACO Associates, (2) "*Recommended Setback for a Bluff-top Home Based on Erosion-Rate and Factor-of-Safety Considerations, 254 Roundhouse Creek Road, Big Lagoon Park Subdivision, Humboldt County, California*" dated November 7, 2006, prepared by Busch Geotechnical Consultants, and (3) "*Sewage Disposal System Design; New One-Bedroom Single-Family Residence; 254 Roundhouse Creek Road, Big Lagoon, California*" dated December 16, 2011, prepared by LACO Associates. All authorized development shall be located at least 151 feet back from the bluff edge as determined by the LACO August 2010 survey that was the basis for the approved site plan (Exhibit 6).

b. PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the Applicants shall submit, for the Executive Director's review and written approval, evidence that a licensed professional (Certified Engineering Geologist or Geotechnical Engineer) has reviewed and approved: all final plans for site preparation, cut and fill slopes, fill materials, compaction, seismic design, setbacks, foundation design; drainage and erosion control plans; septic design; and the minimum bluff edge setback (at least 151 feet) plot plan, and has certified that each of those plans is consistent with: (i) all of the recommendations specified in the above-referenced geologic reports, including but not limited to the recommendation that the foundations shall be designed to facilitate removal and/or relocation of the structure and its foundation in the future; and (ii) plot plans approved by the California Coastal Commission for the project site.

c. The Permittees shall undertake development in accordance with the approved final plans. Any proposed changes to the approved final plans shall be reported to the Executive Director. No changes to the approved final plans shall occur without a Commission amendment to this coastal development permit, unless the Executive Director determines that no amendment is legally required.

2. **Agreement to Bluff Retreat Monitoring**. By acceptance of this permit, the Permittees agree, on behalf of themselves and all successors and assigns, to the following bluff retreat monitoring requirements for the use of the bluff-top residential parcel (APN 517-251-018):
   a. The Permittees agree to undertake annual bluff measurements pursuant to the approved plan required by Special Condition 4 and to submit annual measurement results to the Executive Director and the County of Humboldt every year by June 1st (i.e., following the end of the previous rainy season) beginning the first year following the date of approval of this coastal development permit (i.e., the first date being 6/1/15);
   b. The Permittees agree to have a Certified Engineering Geologist or Geotechnical Engineer undertake periodic bluff stability analyses pursuant to the approved plan required by Special Condition 4. Bluff stability analyses shall be conducted when the bluff edge measures (1) 125 feet from the authorized single family residence, and (2) 76 feet from the authorized single family residence. The Permittees agree to submit the results of each analysis to the Executive Director and to the County of Humboldt by June 1st following each analysis; and
   c. The Permittees agree to grant reasonable access to Commission staff upon request (with a minimum of 48 hours' notice) to enter the property periodically over the life of the development for bluff monitoring verification purposes.

3. **No Future Bluff or Shoreline Protective Device and Future Removal of Development.**
   a. By acceptance of this permit, the Permittees agree, on behalf of themselves and all successors and assigns, that no bluff or shoreline protective device(s) shall ever be constructed to protect the development approved pursuant to coastal development permit (CDP) 1-12-023, including, but not limited to, the single-family residence or other development under this CDP, in the event that the authorized development is threatened with damage or destruction from waves, erosion, storm conditions, bluff retreat, landslides, ground subsidence, or other natural hazards in the future. By acceptance of this permit, the Permittees hereby waive, on behalf of themselves and all successors and assigns, any rights to construct such devices that may exist under Public Resources Code Section 30235, and agree that the approved development shall never be considered an "existing" structure for purposes of Section 30235.
   b. By acceptance of this permit, the Permittees further agree, on behalf of themselves and all successors and assigns, that the landowner(s) shall remove and/or relocate, in part or in whole, the development authorized by this permit, including, but not limited to, the single-family residence and other development authorized under this CDP, when any government agency orders removal of the development in the future or when the development becomes threatened by erosion in accordance with criteria specified in the approved plan required by Special Condition 4, whichever happens sooner. Development associated with removal of the residence and/or other authorized development shall require an amendment to this CDP. In the event that portions of the development fall to the beach before they are removed, the landowner(s) shall remove all recoverable debris associated with the development from the beach and ocean and lawfully dispose of the material in an approved disposal site. Such removal shall require an amendment to this CDP.

4. Bluff Monitoring and Reporting Plan. PRIOR TO ISSUANCE OF THIS COASTAL DEVELOPMENT PERMIT, the Applicants shall submit, for the Executive Director's review and written approval, a plan prepared by a Certified Engineering Geologist or Geotechnical Engineer for conducting annual measurements and periodic analyses of bluff stability at and adjacent to the subject site, as required by Special Condition 2.

a. The bluff monitoring and reporting plan shall demonstrate and include, at a minimum, the following:

i. Provisions for establishing, within 180 days of approval of this coastal development permit (i.e., by 8/12/14), monuments or points of measurement to be located both (1) at or adjacent to the westernmost point of the residence foundation, and (2) at or adjacent to the westernmost point of the septic system leach field line(s);

ii. Provisions for the Permittees and/or their successors in interest to conduct annual measurements of the distance between each established monument and the bluff edge, as defined by CCR§13577(h), a minimum of once annually, at similar times each spring, for the life of the authorized development, with measurement reporting including at least the following: the distances to the bluff edge from each established monument measured to the nearest foot, date of the measurement, identification of the person making the measurement, and, one or more photos of the bluff if retreat of more than 5 feet has occurred since the prior year;

iii. Provisions for a Certified Engineering Geologist or Geotechnical Engineer to conduct a quantitative bluff stability analysis and submit the analysis to the Executive Director and to Humboldt County when the bluff edge measures (1) 125 feet from the authorized development, and (2) 76 feet from the authorized development, as reported by the annual measurements.

A. Each quantitative bluff stability analysis shall include a detailed assessment of bluff stability (including an investigation of bluff profile, cracking, seeps, a review of annual bluff measurements, and a quantitative slope stability analysis based on soil strength parameters contained in the 11/7/06 report by Busch Geotechnical Consultants, or upon updated studies if available) and recommendation as to whether or not the approved development remains in a stable location on the bluff top.

B. For the purposes of these analyses, "stable location" shall be defined as inland of the 1.5 factor of safety established by the qualitative bluff stability analysis or a minimum distance of 60 feet between the bluff edge and the authorized development, whichever is greater;

iv. Provisions for submittal of results of annual measurements and results of quantitative bluff stability analyses to the Executive Director and to Humboldt County by June 1st of each year following each monitoring and analysis event, as applicable; and

v. Provisions requiring that if any governmental agency orders removal of the development or if the results of annual measurements and/or bluff stability analyses indicate that either the primary leach field system or the other development approved pursuant to coastal development permit (CDP) 1-12-023,

is not located in a stable location (as defined in subsection iii.B above), the Permittees shall submit a plan and schedule for abandoning and removing the unsafe development. In the event that only the primary septic lines, but not the residence, are not located in a stable location as defined in subsection iii.B above and require removal, the plan and schedule shall include provisions for constructing the approved reserve septic leach field landward of the approved residence in accordance with County Division of Environmental Health standards and for connecting the residence to the new system prior to abandonment and removal of the threatened leach field lines. Removal and/or relocation activities shall be processed as amendment(s) to this CDP, unless the Executive Director determines that no amendment is legally required. The Permittees shall, within 90 days of submitting the plan for removal and/or relocation, apply for the CDP amendment for removal and/or relocation of the development.

b. The Permittees shall monitor and report on the bluff and apply for removal of the development in accordance with the approved final plan. Any proposed changes to the approved final plan shall be reported to the Executive Director. No changes to the approved final plan shall occur without a Commission amendment to this coastal development permit, unless the Executive Director determines that no amendment is legally required.

5. Disclosure of Permit Conditions. All documents related to any future marketing and sale of the subject property, including but not limited to marketing materials, sales contracts, deeds, and similar documents, shall notify buyers of the terms and conditions of this coastal development permit including but not limited to the fact that:

a. Development is confined to a surveyed building envelope, and development seaward of the approved residence is prohibited except for maintenance of native landscaping and maintenance and eventual removal of the approved septic leach field lines;

b. The site is subject to extreme coastal hazards including, but not limited to, episodic and long-term shoreline retreat and coastal erosion, landslide, seismic hazards, and geologic instability, and development cannot be set back far enough to assure structural stability for its lifespan;

c. Shoreline protective device(s), including but not limited to seawalls, revetments, gunnite, upper bluff retaining walls, caissons, gabion baskets, etc., are prohibited to protect the development authorized by coastal development permit (CDP) 1-12-023, and the approved structure will not be considered to be an existing structure for purposes of Coastal Act Section 30235; and

d. The single family residence authorized by CDP 1-12-023 must be constructed of a foundation system that facilitates moving the structure and its foundation in the future and must be removed or relocated when either any government agency orders removal or when the bluff becomes unstable as determined by required monitoring.

6. Assumption of Risk, Waiver of Liability, and Indemnity Agreement. By acceptance of this permit, the Permittees acknowledge and agree (a) that the site may be subject to hazards from earthquakes, erosion, landslides, bluff failure, and other geologic hazards; (b) to assume the risks to the Permittees and the property that is the subject of this permit of

injury and damage from such hazards in connection with this permitted development; (c) to unconditionally waive any claim of damage or liability against the Commission, its officers, agents, and employees for injury or damage from such hazards; and (d) to indemnify and hold harmless the Commission, its officers, agents, and employees with respect to the Commission's approval of the project against any and all liability, claims, demands, damages, costs (including costs and fees incurred in defense of such claims), expenses, and amounts paid in settlement arising from any injury or damage due to such hazards**.**

7. Deed Restriction Recordation of Permit Conditions. PRIOR TO ISSUANCE OF THIS COASTAL DEVELOPMENT PERMIT, the Applicants shall submit, for the Executive Director's review and written approval, documentation demonstrating that the Applicants have executed and recorded against the parcel(s) governed by this permit a deed restriction, in a form and content acceptable to the Executive Director: (a) indicating that, pursuant to this permit, the California Coastal Commission has authorized development on the subject property, subject to terms and conditions that restrict the use and enjoyment of that property; and (b) imposing the Special Conditions of this permit as covenants, conditions, and restrictions on the use and enjoyment of the property. The deed restriction shall include a legal description of the entire parcel or parcels governed by this permit. The deed restriction shall also indicate that, in the event of an extinguishment or termination of the deed restriction for any reason, the terms and conditions of this permit shall continue to restrict the use and enjoyment of the subject property so long as either this permit or the development it authorizes, or any part, modification, or amendment thereof, remains in existence on or with respect to the subject property**.**

8. Future Development Restriction. This permit is only for the development described in coastal development permit (CDP) 1-12-023. Pursuant to Title 14 California Code of Regulations (CCR) Section 13250(b)(6), the exemptions otherwise provided in Public Resources Code (PRC) Section 30610(a) shall not apply to the development governed by the CDP 1-12-023. Accordingly, any future improvements to this structure authorized by this permit shall require an amendment to CDP 1-12-023 from the Commission or shall require an additional CDP from the Commission. In addition thereto, an amendment to CDP 1-12-023 from the Commission or an additional CDP from the Commission or from the applicable certified local government shall be required for any repair or maintenance identified as requiring a permit in PRC Section 30610(d) and Title 14 CCR Sections 13252(a)-(b)**.**

9. Lighting Limitations. All exterior lighting attached to the authorized structures shall be low-wattage and downcast shielded such that no glare will be directed beyond the bounds of the property**.**

10. Construction Responsibilities. The Permittee(s) shall adhere to various construction-related best management practices (BMPs) including, but not limited to, the following**:**

a. No construction materials, debris, or waste shall be placed or stored where it may be subject to falling over the bluff edge, entering coastal waters, or entering environmentally sensitive areas;

b. Any and all debris resulting from construction activities shall be removed from the project site and disposed of properly;

c. During the course of the project work, all trash shall be properly contained, removed from the work site on a regular basis, and properly disposed of to avoid dispersal of litter and contamination of habitat during demolition and construction activities;

d. All on-site stockpiles of construction debris and soil or other earthen materials shall be covered and contained whenever there is a potential for rain to prevent polluted water runoff from the site; and

e. BMPs shall be used to prevent the entry of polluted stormwater runoff into coastal waters and wetlands during construction and post-construction, including the use of BMPs to capture and clean up any accidental releases of oil, grease, fuels, lubricants, or other hazardous materials. In addition, relevant BMPs as detailed in the current California Storm Water Quality Best Management Handbooks (http://www.cabmphandbooks.com) shall be used including, but not limited to, construction BMPs for the use of silt fencing and protection of storm drain inlets and post-construction BMPs for site design and landscape planning, roof runoff controls, alternative building materials, vegetated buffer strips, and bioretention.

11. Drainage, Erosion, and Runoff Control Plans. PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the Applicants shall submit, for the Executive Director's review and written approval, Drainage, Erosion, and Runoff Control Plans. The plans shall incorporate design elements and/or Best Management Practices (BMPs) which will serve to minimize the volume and velocity of stormwater runoff leaving the developed site, and to capture sediment and other pollutants contained in stormwater runoff from the development, by facilitating on-site infiltration and trapping of sediment. The final drainage and runoff control plans shall, at a minimum, include the following:

a. Runoff from the roofs, driveways and other impervious surfaces shall be collected and directed into pervious areas on the site for infiltration to the maximum extent practicable in a non-erosive manner, prior to being conveyed off-site. Where gutters and downspouts are used, velocity reducers shall be incorporated, to prevent scour and erosion at the outlet;

b. Runoff from impervious surfaces shall be designed to sheet-flow through biofilters or other filtration oriented BMPs;

c. Vegetation at the site shall be maintained to the maximum extent possible, and any disturbed areas shall be replanted or seeded with native vegetation immediately following project completion;

d. Provisions for maintaining the drainage system, including structural BMPs, in a functional condition throughout the life of the approved development. Such maintenance shall include, but shall not be limited to, the following: (1) BMPs shall be inspected, cleaned and repaired when necessary prior to the onset of the storm season, no later than September 30th each year, and (2) should any of the project's surface or subsurface drainage/filtration structures or other BMPs fail or result in increased erosion, the Permittees/landowner or successor-in-interest shall be responsible for any necessary repairs to the drainage/filtration system or BMPs and restoration of the eroded area. Should repairs or restoration become necessary, prior

to the commencement of such repair or restoration work, the Permittees shall submit a repair and restoration plan to the Executive Director to determine if an amendment or new coastal development permit is required to authorize such work; and

e. The plans shall be consistent with the drainage and erosion control recommendations contained in the 12/16/11 LACO Associates report as required by Special Condition 1.

The Permittees shall undertake development in accordance with the approved final plans. Any proposed changes to the approved plans shall be reported to the Executive Director. No changes to the approved plans shall occur without a Coastal Commission approved amendment to this coastal development permit unless the Executive Director determines that no amendment is legally required.

12. Tree Removal Restrictions. Authorized tree removal is prohibited during the bird breeding/nesting season period of March 15 through August 15**.**

13. *Cortaderia* Removal and Landscaping Restrictions.

a. The Permittees shall (1) remove all Pampas grass (*Cortaderia* spp.) from areas of the subject parcel within a minimum 100-foot radius of the approved development, (2) replant or re-seed according to the requirements of part (b) below, and (3) monitor the site for five (5) years according to the requirements of part (c) below;

b For the purposes of re-seeding or planting (1) areas disturbed during the removal of Pampas grass (*Cortaderia* spp.) or other invasive species or (2) any other planting on the property, only native and/or non-invasive plant species shall be planted. No plant species listed as problematic and/or invasive by the California Native Plant Society, the California Invasive Plant Council, or as may be identified from time to time by the State of California, shall be employed or allowed to naturalize or persist on the site. No plant species listed as a "noxious weed" by the governments of the State of California or the United States shall be utilized within the bounds of the property;

c PRIOR TO THE ISSUANCE OF THIS COASTAL DEVELOPMENT PERMIT, the Applicants shall submit, for the Executive Director's review and written approval, a five (5) year monitoring program to ensure the replanted areas remain free of invasive plants for no less than five years, for review and approval of the Executive Director, which incorporates detailed methods for (1) identifying Pampas grass (*Cortaderia* spp.) and other potential invasive plant species from areas of the subject parcel within a minimum 100-foot radius of the approved development following initial removal of Pampas grass (*Cortaderia* spp.), and (2) removing the Pampas grass (*Cortaderia* spp.) and other invasive plant species in the affected area and. The permittee shall undertake development in accordance with the approved final plan. Any proposed changes to the approved final plan shall be reported to the Executive Director. No changes to the approved final plan shall occur without a Commission amendment to this coastal development permit unless the Executive Director determines that no amendment is required; and

d. The use of rodenticides containing anticoagulant compounds, including but not limited to, Bromadiolone, Brodifacoum, or Diphacinone, is prohibited on the property that is the subject of this coastal development permit.

14. Protection of Archaeological Resources.

a. If an area of historic or prehistoric cultural resources or human remains are discovered during the course of the project, all construction shall cease and shall not recommence except as provided in subsection (b) hereof, and a qualified cultural resource specialist shall analyze the significance of the find.

b. A Permittee seeking to recommence construction following discovery of the cultural deposits shall submit an archaeological plan for the review and approval of the Executive Director, prepared in consultation with the THPO of the Yurok Tribe and/or other appropriate tribal representatives.

i. If the Executive Director approves the Archaeological Plan and determines that the Archaeological Plan's recommended changes to the proposed development or mitigation measures are *de minimis* in nature and scope, construction may recommence after this determination is made by the Executive Director.

ii. If the Executive Director approves the Archaeological Plan but determines that the changes therein are not *de minimis,* construction may not recommence until after an amendment to this permit is approved by the Commission.

15. Liability for Costs and Attorney's Fees. The Permittees shall reimburse the Coastal Commission in full for all Coastal Commission costs and attorney's fees – including (1) those charged by the Office of the Attorney General, and (2) any court costs and attorney's fees that the Coastal Commission may be required by a court to pay – that the Coastal Commission incurs in connection with the defense of any action brought by a party other than the Permittees 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 Permittees 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.

IV. FINDINGS AND DECLARATIONS

The Commission hereby finds and declares as follows:

A. PROJECT DESCRIPTION

The Applicants propose to (1) develop a 0.33-acre vacant, undeveloped lot with a new ~1,200-square-foot, one-bedroom, two-bathroom, one-story, maximum 15-foot-high single-family residence, 110-square-foot and 45-square-foot porches, a 150-gallon above-ground propane tank with a three-foot-high redwood screening frame and lattice, partially paved/partially gravel driveway and parking area with two off-street tandem parking spaces, an on-site sewage disposal system, water line, drainage swale, and 100 square feet of landscaping; and (2) remove approximately 22 Sitka spruce trees ranging between 12 and 24 inches in diameter at breast height (dbh). Project plans are attached as **Exhibit 6**.

B. BACKGROUND AND ENVIRONMENTAL SETTING

The subject property is located at 254 Roundhouse Creek Road (APN 517-251-018) in the Big Lagoon Estates Subdivision of northern Humboldt County (**Exhibits 1-3**). The approximately 0.33-acre lot is generally flat, vegetated with young Sitka spruce forest vegetation, and located on an uplifted marine terrace at an elevation of approximately 125 feet above mean sea level.

The proposed new development would be located a minimum of 151 feet back from the existing bluff edge (**Exhibit 6**). Although the subject site is located on the west side of Roundhouse Creek Road, it is not the westernmost lot. An undeveloped, partially eroded lot owned by the County is located between this property and the bluff edge (**Exhibit 3**). The County's lot was purchased from private ownership with funds awarded under a FEMA hazard mitigation grant in response to severe storm damage to the bluff in 1999, as discussed below.

The Big Lagoon Estates Subdivision has been subject to extraordinary rates of bluff retreat in the past. The subdivision lies on a bluff composed of poorly consolidated terrace sands, where the bedrock layer (Franciscan formation) lies below sea level.[1] Periodic instances of extraordinary bluff retreat typically occur when factors such as large waves, high tides, and loss of beach sand expose the bluffs to direct wave attack (e.g., during El Niño events). Rapid rates of bluff erosion have been measured from aerial photographs for the 1930s (58 feet of bluff retreat in a decade),[2] winter 1941/1942 (30 feet in a season),[3] 1980s (at least 55 feet),[4] and winter 1997/1998 (60 feet in a season).[5] These sudden episodes of catastrophic bluff failure have led to emergency relocations of homes on several occasions, including an emergency house relocation from 268 Roundhouse Creek Road (the lot immediately adjacent to the subject site to the southwest) in January of 1999 (CDP 1-98-075, Wall); an emergency house relocation from 176 Roundhouse Creek Road (~300 feet north of the subject site) in September of 1999 (de minimis waiver 1-99-066-W, Kavich); and an emergency house relocation from 294 Roundhouse Creek Road (~200 feet south of the subject site) in 2003 (emergency permit 1-03-027-G and CDP 1-03-028, Rohner). See **Exhibits 4 and 5** depicting home relocation sites relative to the subject site. In addition, 28 cabins located in the Big Lagoon Park community, located less than one half-mile north of the subject property, have had to be relocated over the years due to episodic retreat events (e.g., see CDP 1-84-222, Big Lagoon Park Company).

The subject undeveloped lot is vegetated with several large conifer trees (mostly smaller Sitka spruce trees). As a result, these trees and trees on the adjoining lots to the west block virtually all views to the ocean from Roundhouse Creek Road and other public vantage points in this particular area.

Based on a query of the California Natural Diversity Database and an investigation of the property by Commission staff, there are no wetlands or other known environmentally sensitive habitat areas located on or immediately adjacent to the property. However, it is possible that the

[1] Busch Geotechnical Consultants, November 7, 2006, page 6 (see **Exhibit 7**)
[2] See CDP File 1-84-222 (Big Lagoon Park Co.)
[3] Ibid.
[4] See CDP File 1-85-130 (Haddock)
[5] See CDP File 1-98-075 (Wall) and *de minimis* Waiver File 1-99-066-W (Kavich)

existing mature conifer trees on the property support seasonal breeding and nesting habitat for birds protected under the state Fish and Game Code and federal Migratory Bird Treaty Act.

There is no evidence of public use of the property for public access, no evidence of trails on the property, and no indication from the public that the site has been used for public access purposes in the past. The potential opportunities for public access to nearby beach and shoreline areas include an informal trail to Agate Beach, within Patricks Point State Park, located about a third of a mile south, beyond the end of Roundhouse Creek Road, and informal access to the Big Lagoon County Park beach approximately a quarter mile to the north, near the bluff failure area at the north end of Ocean View Drive. In addition, Big Lagoon County Park is located less than a mile north of the property.

C. STANDARD OF REVIEW

Although Humboldt County has a certified local coastal program (LCP), the property is located in a non-certified area that includes all of the lots in the Big Lagoon subdivision that are locally planned and zoned for residential use and located on the west side of Roundhouse Creek Road and Ocean View Drive. As a consequence, the Commission retains CDP jurisdiction over the site, and the standard of review for issuance of a CDP is whether the development is consistent with the Chapter 3 policies of the Coastal Act.

D. OTHER AGENCY APPROVALS

Humboldt County

The proposed development requires a special permit from Humboldt County for the design review and major vegetation removal aspects of the proposed project. The County approved SP-12-029 for the development on October 16, 2013.

E. LOCATING AND PLANNING NEW DEVELOPMENT

Section 30250(a) of the Coastal Act states that new development shall be located within or near existing developed areas able to accommodate it or in other areas with adequate public services and where it will not have significant adverse effects, either individually or cumulatively, on coastal resources. The intent of this policy is to channel development toward more urbanized areas where services are provided and avoid significant adverse impacts to coastal resources.

The subject property, which is undeveloped, is located within a developed rural residential neighborhood. The property is locally planned and zoned as “Residential Single-Family with No Further Subdivision Allowed” and a “Design Review” combining zone. The CDP application does not include a subdivision proposal, and the proposed new single-family residence is a principally permitted use according to the parcel’s local zoning designation.

The County Division of Environmental Health (DEH) has indicated that the proposed on-site sewage disposal system is acceptable as proposed to serve the proposed one-bedroom dwelling, and the DEH will oversee construction/installation of the new system under permits issued through the County Building Division. In addition, the proposed new residence will be connected to the public water system managed by the Big Lagoon Community Services District. Thus, there are adequate sewage and water systems to serve the proposed development.

Although the subject site is located in a geologically hazardous area, as discussed in Finding IV.H below, the development has been conditioned to minimize geologic hazards, assure stability, and avoid erosion and landform alteration to the maximum extent feasible consistent with the requirements of Sections 30010 and 30253 of the Coastal Act (see Findings IV-F and G below). Furthermore, as discussed in Findings IV-I through L below, the project has been conditioned to protect visual resources, water quality, environmentally sensitive habitat areas and surrounding park and recreation areas, and archaeological resources.

Therefore, the Commission finds that as conditioned, the proposed development is consistent with Coastal Act Section 30250(a), in that it is located in a developed area, has adequate water and sewer capability to accommodate it, and will avoid significant adverse effects, individually and cumulatively, to coastal resources to the maximum extent feasible consistent with the requirements of Section 30010 of the Coastal Act.

F. GEOLOGIC HAZARDS

Section 30253 of the Coastal Act states, in applicable part, as follows:

> *New development shall do all of the following:*
>
> *(a) Minimize risks to life and property in areas of high geologic, flood, and fire hazard.*
>
> *(b) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.*

As summarized above, the intent of Section 30253 is, in part, to avoid shoreline hazards (erosion, bluff retreat, flooding, etc.) by siting new development away from the shoreline hazards and far enough back from bluff edges as to be safe for the development's expected lifespan.

The ~0.33-acre property is located in the Big Lagoon Estates Subdivision on the west side of Roundhouse Creek Road on an uplifted marine terrace about 125 feet above mean sea level. The marine terrace is nearly a mile in length, extending from Agate Beach to the south to north of the end of Oceanview Drive, where episodes of catastrophic bluff failure have occurred in the past (as discussed above and in detail below). According to the Commission's geologist, Dr. Mark Johnsson, the area has experienced some of the greatest long- and short-term coastal erosion rates in the state.

According to the geologic studies conducted for the site, episodic rapid-rate bluff erosion presents the greatest hazard to the subject property. One of the geologic investigations completed for the property (Busch Geotechnical Consultants 2006, **Exhibit 7**) describes (on page 6) the site geology in part as follows (emphasis added):

> *"Along the western edge of the subdivision, erodible marine terrace sediments are exposed at the base of the sea cliff. Franciscan Complex bedrock, which is exposed in the*

> *headlands of Patrick's Point State Park* [south of the subject property] *and on the north side of Big Lagoon, across the Big Lagoon fault, does not outcrop at the base of the bluff in the subdivision. Here the beach is unprotected by offshore rocks or a nearby headland, so whenever winter storm waves strip the sand from the beach, the base of the bluffs – whether talus or in-situ soil units – begins to erode. At times the result is rapid-rate erosion of the bluff (e.g., Tuttle, 1981)."*

The geotechnical report further describes (on pages 8-9) the bluff failure processes that affect the Big Lagoon Estates Subdivision lots in part as follows (emphasis added):

> *"In the Big Lagoon area, bluff failures are caused primarily by marine undercutting of the base of the erodible marine terrace sediments. As the base of the bluff erodes to an over-steepened slope angle (~70° to near vertical), the sediments fail as planar slides, debris slides, and 'flake' failures of coherent blocks of sediment. Over time these failures cause the top-of-bluff to 'backwaste' or 'erode back.'*
>
> *…When the protective beach is gone, marine undercutting of the base of the bluff begins, followed by rapid-rate bluff back-wasting. Furthermore, erosion remains more rapid afterwards, at least at sites where erodible bluffs have lost their beach, until the beach profile approaches its 'normal' configuration…As a result of the interaction of these complex factors, at least three of the five past strong El Niños (1940-41, 1941-42, and 1997-98) have triggered an episode of rapid-rate bluff erosion in the Big Lagoon area…*

Another more recent geotechnical report completed for the property (LACO Associates 2011, **Exhibit 8**) also discusses the geologic setting and some of the hazards affecting the site (pages 6-7, emphasis added):

> *"Events of the recent past indicate the coastal bluffs along this stretch of coast to be highly susceptible to slope failure… Bluff retreat is characterized by sudden and catastrophic slope failure that involves the entire bluff as opposed to gradual 'grain to grain' erosion and retreat….*
>
> *Evidence of historic slope failure and coastal bluff retreat is observable along the entire coastal bluff from Agate Beach to Big Lagoon. This section of coastal bluff has a higher potential for slope failure, in general, than many areas of Humboldt County due to (among other factors) the over-steepened sea cliff and easily erodible marine terrace deposits, high annual precipitation, and direct exposure to northwest winter swells coupled with a steep wave slope. An additional contributing factor is the lack of an offshore bar, which would otherwise dissipate wave energy prior to reaching the shoreline. The potential for slope instability and coastal bluff failure to adversely affect the project site is therefore considered to be high…"*

In summary, due to a variety of factors including (1) the lack of offshore rocks or an offshore bar in the area to dissipate wave energy prior to reaching the shoreline, thereby leaving the bluff directly exposed to northwest winter swells, (2) the periodic absence of a protective beach at the base of the bluff, especially during El Niño years when winter water height is higher than

average and there is a greater frequency of large storms, (3) the over-steepened bluff face and tendency for waves to undercut the erodible marine terrace sediments, causing rapid-rate bluff back-wasting, and (4) on average, relatively high annual precipitation, bluff retreat in the Big Lagoon area is characterized by sudden and catastrophic slope failure rather than gradual "grain to grain" erosion and retreat, as described above.

The Busch report provides a calculation of bluff erosion rates for the subject bluff and a quantitative assessment of the bluff stability. Based on the results of these calculations and analyses, the report recommends a minimum setback distance of 151 feet from the top-of-bluff for construction of the home foundation. This distance includes a setback of 76 feet from the most distant bluff failure surface measured to ensure the minimum factor of safety (FOS) recommended by the Commission's geologist[6] plus a setback of an additional 75 feet to account for the estimated historic bluff retreat rate of 1.0 feet per year (multiplied by the development's lifespan of 75 years). This recommended setback distance includes the entire western half of the 0.33-acre subject lot.

The Applicants propose to construct the home, as well as the driveway, secondary leach field, and most of the proposed development at least 151 feet back from the existing bluff edge within the eastern side of the lot, consistent with the recommendations of their consulting geologists. However, due to constraints related to County requirements on front yard setbacks, off-street parking, and on-site septic systems, the Applicants also propose that the primary leach field, which has an expected lifespan of approximately 30 years, be located as close as 139 feet from the bluff edge. In addition, the Applicants propose to excavate and seed a grassy swale for runoff control purposes between about 135 feet and 150 feet from the bluff edge.

The Commission's geologist, Dr. Mark Johnsson, reviewed the geotechnical report and agreed with some, but not all, of its conclusions and recommendations (**Exhibit 9**). Dr. Johnsson believes that the recommended FOS setback distance of 76 feet is large enough to achieve a FOS of 1.5, which is the industry standard. However, Dr. Johnsson believes the report's proposed bluff retreat setback is deficient, because it does not adequately account for the effects of future sea-level rise and climate change on bluff stability. Dr. Johnsson references the Commission's draft sea-level rise guidance document[7], which articulates the various methodologies that can be utilized by the Commission in adjusting historic bluff retreat rates for future rising seas:

> There is no fully-accepted methodology for estimating future bluff erosion with sea-level rise. Guidance for coastal analysts in Hawaii is to assume erosion will increase as a proportion of historic erosion (Hwang, 2005). One approach used in the past by the Commission has been to use the high range of historic erosion rates to represent average future trends. A more process-based methodology, used in the Pacific Institute study of erosion due to rising sea level, is to correlate future erosion rates of bluffs with increased frequency of wave impacts (Heberger et al., 2009; Revell, 2011). This approach assumes

[6] Johnsson, M.J., 2005. *Establishing development setbacks from coastal bluffs*. In Magoon, O.T., Converse, H., Baird, B., Jines, B., and Miller-Henson, M., eds., California and the World Ocean '02: Revisiting and revising California's Ocean Agenda: Reston, Virginia, American Society of Civil Engineers, p. 396-416.

[7] See page 137 of Appendix B of the Draft Sea Level Rise Guidance document, accessible from http://www.coastal.ca.gov/climate/SLRguidance.html

> that all bluff erosion is due to wave impacts, and erosion rates will change over time as the beach or bluff experiences more frequent or more intense wave attack. Such an approach should be considered for examining bluff erosion with rising sea level. Other approaches that recognize the influence of water levels in beach, bluff, or dune erosion can also be used.

In this case, Dr. Johnsson recommends using the high range of historic erosion rates to represent average future trends rather than the more process-based methodology described above, which is relatively untested. A recent geotechnical report (LACO Associates 2012) for a nearby parcel (396 Roundhouse Road, approximately 700 feet south of the subject parcel[8]) summarized available data [note that distance from that subject site in the below table has been adjusted to refer to the Winget property]:

Table 4: Comparison of Bluff Retreat Rate Estimations for Big Lagoon Area

Source	*Distance from site*	*Time Span (years)*	*Estimated Retreat Rate (feet per year)*
Tuttle, 1981	*500 and 900 feet South*	*34*	*1.5 to 2.7*
Busch, 2003	*400 feet South*	*61*	*1.0*
LACO, 2006	*200 feet North*	*58*	*1.5*
LACO, 2012	*200 feet South*	*64*	*1.25*

The very high rate of 2.7 ft/year reported by Tuttle (1981) for a site 900 feet south of the subject site may be an anomaly associated with the gulley that exists near that location. But Tuttle (1981) and LACO (2006) report a rate of 1.5 ft/year for nearby sites (as shown above) on the same uplifted marine terrace. These sites are located within 500 feet of the project site and are similarly situated as bluff top lots above a uniformly eroded linear bluff face.

In the opinion of Dr. Johnsson, 1.5 ft/year is an appropriate rate to use in estimating future bluff retreat, as this rate is consistent with the higher range of bluff retreat rates that have been estimated for the subject bluff and therefore is expected to account for future bluff erosion related to sea-level rise effects. According to the best available science on future sea-level rise,[9] relative sea level north of Cape Mendocino is expected to rise between -1 inch (i.e., sea level fall) to 18 inches by 2050 and 4 to 56 inches by 2100. The Commission finds that it is especially important to consider future sea-level rise effects on bluff stability in this particular location given the various factors discussed above including (1) the lack of offshore rocks or an offshore bar in the area to dissipate wave energy prior to reaching the shoreline, thereby leaving the bluff directly exposed to northwest winter swells, (2) the periodic absence of a protective beach at the base of the bluff, especially with large storm events and when winter water height is higher than average, (3) the fact that bedrock lies below sea level, and there is a tendency for waves to undercut the erodible marine terrace sediments of the over-steepened bluff face, causing rapid-rate bluff back-wasting. As previously discussed, all of these factors have led to the sudden and catastrophic failure of

[8] See CDP 1-12-013 (Wilson) approved 11/14/12 accessible from http://documents.coastal.ca.gov/reports/2012/11/W10a-11-2012.pdf

[9] National Research Council, 2012.

the bluff adjacent to and north and south of the subject site (see **Exhibits 4 and 5** showing surrounding home removals due to bluff retreat hazards). Using the average bluff retreat rate of 1.5 ft/year increases the expected amount of bluff retreat by 37.5 feet as compared to the amount of bluff retreat derived using the 1.0 ft/year rate recommended in the Busch report, for a total amount of bluff retreat of 112.5 feet over the next 75 years. Combining this amount of expected bluff retreat with the 76-ft setback needed to assure stability against sliding today, as discussed above, results in a total recommended setback of approximately 189 feet from the bluff edge. Using the average bluff retreat rate of 1.5 ft/year, the Applicants' proposed setback distance of 151 feet yields only 50 years until the structure would likely be threatened by bluff instability.[10]

The Applicants' geologic studies indicate that geologic consultants specify a project lifespans for oceanside homes affected by bluff retreat and the project lifespan is "usually 75 years on the California Coast" (Busch report, pg. 22). Many older homes of this age exist in the project vicinity. For example, many of the homes in the Big Lagoon area are on average about 70 years old, including approximately 66 cabins (some seasonal, some year-round) on the Big Lagoon Park Company property (located less than one half-mile north of the subject site) that have retained their original (1930s) exterior materials and square footages.[11] These homes built in the 1930's are now 74 to 84 years old. Section 30253 requires that new development assure stability and structural integrity without protective devices and setbacks be sufficiently large to allow for natural processes to continue without the adverse impacts to coastal resources and public access that would be associated with the introduction of hard protective devices. A setback that considers both bluff stability and an expected average future annual erosion rate that accounts for geologic hazards both now and into the future (including risks related to future sea-level rise effects on the bluff), in this case 189 feet as recommended by Dr. Johnsson, assures consistency with Section 30253. While the Applicants' geologic studies used a lifespan of 75 years for the proposed new residence in their setback recommendations, they failed to use a long-term average annual erosion rate that accounts for future bluff erosion related to sea-level rise effects.

Given that the eastern (inland) boundary line of the subject property lies approximately 181 feet to 195 feet from the bluff edge, it is not possible to site any proposed residential development on the property in a safe location (i.e., set back at least 189 feet from the bluff edge). Thus, the proposed development is inconsistent with Section 30253 of the Coastal Act because the Applicants cannot demonstrate that the new residence will assure stability and structural integrity without reliance on future shoreline protection. This finding justifies denial of the proposed development. However, in this case, as discussed below in Findings IV-G and IV-H, the Commission has determined that it must allow a reasonable residential development on the subject property to avoid an unconstitutional taking of the Applicants' property without payment of just compensation.

[10] Calculated by taking the Applicants' proposed setback distance (151 feet), subtracting 76 feet (the recommended setback needed to assure stability today, as determined by the quantitative bluff stability analysis), and then dividing that number (=75) by 1.5 (which is the more conservative annual average bluff retreat rate recommended by Dr. Johnsson, versus the consulting geologists' recommended rate of 1.0 ft/yr.).

[11] Pers. comm., Don Tuttle, former director of Humboldt County Public Works Department, Natural Resources Division, and President of the Board of the Big Lagoon Park Company, (email dated 1-25-14).

G. TAKINGS

The Coastal Act

As discussed above, the proposed project is inconsistent with the hazard-avoidance policies of the Coastal Act. Alternatives to reduce scale of the project or to allow other kinds of development west of the necessary setback would likely be inconsistent with the Coastal Act as well. In other words, absent takings concerns, the Commission would deny the permit. However, denial of all economic use of a parcel without just compensation may result in an unconstitutional "taking" of an applicant's property. Coastal Act Section 30010 expressly forbids this result:

> *The Legislature hereby finds and declares that this division is not intended, and shall not be construed as authorizing the commission… to exercise their power to grant or deny a permit in a manner which will take or damage private property for public use, without the payment of just compensation therefore.*

Consequently, the Coastal Act imposes on the Commission the duty to assess whether its action might constitute a taking. If the Commission concludes that its action does not constitute a taking, then it may deny the project on finding that its actions are consistent with Section 30010. If the Commission determines that its action would constitute a taking, then it applies Section 30010 to consider how the project may be approved. In the latter situation, the Commission may propose modifications to the development to minimize any Coastal Act inconsistencies, while still allowing a reasonable amount of development.[12]

In the remainder of this section, the Commission considers whether, for purposes of compliance with Section 30010, its denial of the project would constitute a taking.

Takings Law

The Fifth Amendment of the United States Constitution provides that private property shall not "be taken for public use, without just compensation."[13] Article 1, section 19 of the California Constitution provides that "[p]*rivate property may be taken or damaged for public use only when just compensation…has first been paid to, or into court for, the owner*."

Once used solely for condemnation cases, the Fifth Amendment is now used to require compensation for other kinds of government actions. (See *Pennsylvania Coal Co. v. Mahon*. (1922) 260 U.S. 393,) Since *Pennsylvania Coal*, most of takings cases have fallen into two categories. (See *Yee v. City of Escondido* (1992) 503 U.S. 519, 522-523.) First, there are the cases in which government authorizes a physical occupation of property. (See, e.g., *Loretto v. Teleprompter Manhattan CATV Corp*. (1982) 458 U.S. 419.) Second, there are the cases in which government regulates the use of property. (*Yee, supra*, 503 U.S. at pp. 522-523).

[12] For example, in CDP A-1-MEN-09-023 (Wernette), the Commission in November of 2010 approved residential development that was partially sited on an environmentally sensitive habitat area and was not coastal resource-dependent, and thus was inconsistent with the LCP (the standard of review in that case).

[13] The Fifth Amendment was made applicable to the States by the Fourteenth Amendment (see *Chicago, B. & Q. R. Co. v. Chicago* (1897) 166 U.S. 226).

Because this is not a physical taking of the property, the Commission's actions here would be evaluated under the standards for a regulatory taking.

The Supreme Court has identified two types of regulatory takings. The first is the "categorical" formulation identified in *Lucas v. South Carolina Coastal Council*. ((1992) 505 U.S. 1003, 1014.) In *Lucas*, the Court held, without examining the related public interest, that regulation that denied *all* economically viable use of property was a taking. (*Id*. at p. 1014.) The *Lucas* Court emphasized, however, that this category is extremely narrow, applicable only "in the extraordinary circumstance when *no* productive or economically beneficial use of land is permitted" or the "relatively rare situations where the government has deprived a landowner of all economically beneficial uses" or rendered it "valueless." (*Id*. at pp. 1016-1017 (emphasis in original); see also *Riverside Bayview Homes* (1985) 474 U.S. 121, 126 [regulatory takings occur only under "extreme circumstances"].) Even where the challenged regulatory act falls into this category, government may avoid a taking if the restriction inheres in the title of the property itself; that is, background principles of state property and public nuisance law would have allowed government to achieve the results sought by the regulation (*Lucas, supra*, 505 U.S. at pp. 1028-1036). Generally, a background principle is something that "must inhere in the title itself," that is, the owner did not acquire the right to use the property in that manner on buying the land. (*Id*. at p. 1029.)

The second circumstance in which a regulatory taking might occur is under the three-part, *ad hoc* test identified in *Penn Central Transportation Co. v. New York*. ((1978) 438 U.S. 104, 124 ("*Penn Central*")) Here, if a government action will not deny all economically viable use, this test requires an examination into the character of the government action, its economic impact, and its interference with reasonable, investment-backed expectations. (*Id*. at p. 134; *Ruckelshaus v. Monsanto Co.* (1984) 467 U.S. 986, 1005.) In 2001, the Court reinforced that the *Lucas* categorical test and the three-part *Penn Central* test were the two basic situations in which a regulatory taking might be found. (*Palazzolo v. Rhode Island* (2001) 533 U.S. 606, 616 [rejecting *Lucas* categorical test where property retained value following regulation, but remanding for further consideration under the *Penn Central* test.].)

Development for the Project Allowed to Avoid a Taking

The Commission interprets Section 30010, together with the *Lucas* decision, to mean that if denial of the project would likely deprive an applicant's property of all reasonable economic use, the Commission may be required to allow some development, even where a Coastal Act or LCP provision would otherwise prohibit it. Unless the proposed project would constitute a public nuisance under state law or another background principle applies, the Commission may not deny all economic use of the land. The project as proposed would not create a public nuisance sufficient to defeat a takings claim, although it could become one in the future. However, while approving a project that allows the owners reasonable economic use of the land, the Commission must consider alternatives or set conditions that avoid or minimize impacts on coastal resources.

Alternatives

The subject parcel is designated in the County of Humboldt zoning regulations as Residential Single Family (RS) uses. The parcel is located in a residential neighborhood and is currently

undeveloped. While the zoning designation allows other uses besides a home, any development west of the setback presents the same problem, because the development would need to be constructed almost entirely landward of the eastern property line in order to assure a safe location without the need for protective devices. The Commission finds that in this particular case, no economically viable alternatives to the proposed project would both satisfy the Coastal Act and avoid a constitutional taking under *Lucas*.

Conditions

Therefore, the Commission must approve the project in a form that allows reasonable use of the property, while minimizing impacts to coastal resources to the extent feasible. To that end, the Commission's approval would incorporate Special Conditions 1-15; in particular, **Special Conditions 2, 3, and 4** will minimize impacts to the bluff and assure safety of the residents and the public as changing conditions arise.

Conditions of Approval Are Not A Regulatory Taking under *Penn Central*

The project as conditioned does not constitute a regulatory taking. Preliminarily, the deprivation of the economic use – the requirement to remove the house when bluff erosion threatens its safety, which the Commission estimates will take approximately 50 years, does not rise to the level of losing "all" economic use under *Lucas*. (See *supra*, 505 U.S. at pp. 1016-1017.) Neither do the conditions form the kind of substantial injury to the owners' property rights that rises to a taking. (See *Penn Central, supra*, 438 U.S. at p. 130 [finding claim "untenable" that interference with an undeveloped property interest, while viable economic uses continued, constituted a taking].) Likewise, a loss in property value does not constitute a taking. (See *William C. Haas & Co., Inc. v. City and County of San Francisco* (9th Cir. 1979) 605 F.2d 1117 (diminution of property's value by 95% not a taking)]; *Rith Energy v. United States* (Fed.Cir. 2001) 270 F.3d 1347 [in applying *Penn Central*, holding that diminution of property's value by 91% not a taking]). Regardless, under the *Penn Central* test, while the Applicants possess a sufficient property interest, they could not have had a reasonable expectation that a house on this bluff would last forever.

Sufficiency of Interest

In the subject case, the Applicants purchased APN 517-251-018 for $180,000, and on December 11, 2007 a Grant Deed was recorded as Instrument 2007-36062-2 of the Official Records, Humboldt County Recorder's Office, effectively transferring and vesting fee-simple ownership to the Applicants. Upon review of these documents, the Commission concludes that the Applicants have demonstrated that they have sufficient real property interest in the subject parcel to allow pursuit of the proposed project.

Reasonable Investment-Backed Expectations

While not unreasonable to expect to build a home in a residential zone, the Applicants could not have held a reasonable expectation that the house could stay sited in a geologically-hazardous area for 75 years. As stated in above in Finding IV-F (Geologic Hazards), the Applicants' geologist concluded both that wave action in the coming years is unpredictable, and that that there is risk to siting a house on the coastal bluff. The Applicants' geologist's recommendations included a specific recommendation that the house be constructed of a foundation system that facilitates moving the structure and its foundation in the future.

Additionally, as discussed at length above, the Big Lagoon Estates Subdivision has been subject to extraordinary rates of bluff retreat in the past, with many houses relocated. Finally, while there is considerably more data available today, there was substantial awareness of climate change and sea-level rise in 2007, and the Applicants could not have completely ignored the risk of catastrophic failure of the bluff as they purchased the land.

Character of the Governmental Action

The Commission's interest in this case is safety – the protection of people, property, and coastal resources. The Commission is not using the property for a public purpose but rather is regulating the development to assure its stability and structural integrity without the need for protective devices in order to comply with the Coastal Act's requirements in Section 30253. By stating that new development "shall" follow these requirements, the statute is unequivocal. Additionally, as the prime implementer of its own laws and the body that sets policy, the Commission has a further responsibility to maximize compliance of any Coastal Act requirements within the boundaries of takings law.

Because the bluff's erosion cannot be predicted with certainty, **Special Condition 2** requires the Permittees to monitor and report on the bluff's status (as detailed in **Special Condition 4**). This condition protects the public as well as the residents and provides specific facts for any potential removal of the development, as set out in **Special Condition 3**.

Conclusion

To preclude a claim of takings and to assure conformance with California and United States Constitutional requirements, as provided by Coastal Act Section 30010, this permit approval allows for the construction of a residential development to provide a reasonable economic use of the subject property. In view of the evidence that denying all uses on the property could constitute a categorical taking of the Applicants' property interests, and that they had sufficient investment-backed expectations that they could develop their property in some way, there is a reasonable possibility that a court might determine that the final denial of a residential use, based on inconsistencies with the Coastal Act, would constitute a taking. Therefore, the Commission determines that the Applicants are entitled to some development on their property.

Having reached this conclusion, however, the Commission also finds that the Coastal Act only instructs the Commission to construe the applicable Coastal Act policies in a manner that will avoid a taking of property. It does not authorize the Commission to otherwise suspend the operation of or ignore the policies of the Coastal Act in acting on this application. Thus, the Commission must still comply with the requirements of the Coastal Act by approving and siting the development in a manner that is as consistent with the Coastal Act as it can be while avoiding a taking. To achieve better consistency with the Coastal Act requirements, the project must be subject to various special conditions, as discussed in the following section.

H. APPROVABLE PROJECT

Though applicants are entitled under Coastal Act Section 30010 to an assurance that the Commission will not act in such a way as to take their property, this section does not authorize

the Commission to completely avoid application of the policies and standards of the Coastal Act. Instead, the Commission is only directed to avoid construing these applicable policies in a way that would take private property for public use. Aside from this instruction, the Commission is still otherwise directed to enforce the requirements of the Coastal Act. Therefore, in this situation the Commission must still comply with the Coastal Act hazard policies requiring the Applicants to site development on this property as far landward as possible.

Commission staff analyzed approximate sizes (square footages) of 13 existing single family residences on Roundhouse Creek Road within the Big Lagoon Estates Subdivision by using information contained in Commission and County permit files (**Exhibit 10**). This analysis of similarly situated residences, eight of which are located on the west side of Roundhouse Creek Road, demonstrates that the surrounding residential developments in the area have an average floor area of approximately 1,866 square feet. Accordingly, in order to give the Applicants the minimum amount of development to avoid a taking of private property without just compensation, while maximizing consistency with the Coastal Act, the Commission finds that a development envelope allowing a home that is similar in size to surrounding residential development is reasonable.

The applicants are proposing to construct a 1,200-square-foot, one-bedroom, maximum 15-foot-high, single family home with no garage, and all proposed development will be setback at least 151 feet from the bluff edge. This setback would create a development envelope equal to an area of approximately 3,500 square feet. The Applicants have sited the development as far back from the bluff edge as possible. The County's required 20-foot front yard setback precludes siting the home closer to the street, while siting the proposed future reserve leachfield within the front yard setback will serve both to minimize encroachment towards the bluff edge and to maximize the time period during which the house will be feasibly served by a septic system. The primary and reserve leachfield leach lines are oriented in a direction across the width of the property rather than across the length of the property and are relatively narrow to minimize encroachment towards the bluff. As previously mentioned, there will be no garage; instead the Applicants propose uncovered tandem parking to minimize the encroachment of parking area towards the bluff. For all of these reasons, the Commission finds that the proposed development maximizes consistency with Section 30253 of the Coastal Act by providing as much setback from the bluff to minimize bluff retreat hazards while avoiding a taking of private property without just compensation by providing a building envelope that takes into consideration the County's required yard and septic system setbacks at similar bulk and scale to surrounding development. The Commission notes that in the County's approval of the Special Permit for the proposed development, the Applicants completed a Neighborhood Design Survey, which was reviewed by a Design Review Committee. The County determined that the proposed development is compatible with the neighborhood in terms of height, bulk, architectural style, and building materials.

The physical location of the development setback line at the project site was determined from a surveyed based map prepared by a licensed surveyor from LACO Associates in August 2010, which is the basis for the proposed site plan. Therefore, the Commission imposes **Special Condition 1**, which requires the Applicants to submit to the Executive Director for review and approval final project plans for construction demonstrating that the proposed development is

sited entirely within the surveyed building envelope. Special Condition No. 1 also requires that the residence be constructed in conformance with all recommendations related to site preparation, cut and fill slopes, fill materials, compaction, seismic design, setbacks, foundation design, and drainage and erosion control contained in the LACO geotechnical report (**Exhibit 8**) completed for the project.

As discussed above, the residence is not located sufficiently far from the bluff edge to avoid bluff retreat hazards and assure stability and structural integrity without the need for protective devices over the life of the structure. In addition, even the Applicants' geologic report acknowledges that the development would still be subject to some geologic risk even if there was agreement that the 151-foot geologic setback recommended by the Applicants' geologist would be adequate to protect the development from bluff retreat hazards during the life of the structure. The Busch geologic report (**Exhibit 7**) references various "limitations" of the analysis, such as (on page 23):

> *"…Although we have used standard engineering geologic practices and professional standards of care to provide erosion-rate estimates, predictions, and a risk assessment, nothing in this report should be construed to state or imply a guarantee of safety of the home for any specific duration of time. Bluff retreat occurs in a largely unpredictable fashion, and it will continue to occur in the Big Lagoon area into the foreseeable future. Even if we have overstated the risk at the proposed site, and the future realized rate of bluff failure is less than the minimum rate we predict, it is important to understand that LOW risk is not the same as NO risk: rapid-rate bluff failure could occur before the calculated minimum economic lifespan is realized (herein stated as 75 years).*
>
> *In conclusion, although the evaluation presented herein is based on a consideration of the geologic, geodetic, tectonic, and nearshore marine processes active at Big Lagoon, greater or lesser retreat rates than those documented in the past and predicted for the future may be realized in the next 75 years…"*

This language in the report itself is indicative of the underlying uncertainties of this and any geotechnical evaluation and supports the notion that no guarantees can be made regarding the safety of the proposed development with respect to bluff retreat. Geologic hazards are episodic, and bluffs that may seem stable now may not be so in the future. As discussed above in Finding IV-B, the Big Lagoon Estates Subdivision has been subject to extraordinary rates of bluff retreat in the past, and rapid rates of bluff erosion have been documented for the 1930s (58 feet of bluff retreat in a decade),[14] winter 1941/1942 (30 feet in a season),[15] 1980s (at least 55 feet),[16] and winter 1997/1998 (60 feet in a season).[17] These sudden episodes of catastrophic bluff failure have led to emergency relocations of homes on several occasions (as detailed in **Exhibits 4-5**). Both the Commission's geologist and the Applicants' consulting geologists agree that there is a high probability of bluff collapse in the future. Bluff failure may be sudden and catastrophic, as it

[14] See CDP File 1-84-222 (Big Lagoon Park Co.)

[15] Ibid.

[16] See CDP File 1-85-130 (Haddock)

has been on multiple occasions in the past (see Finding IV-F above and Dr. Johnsson's memo, **Exhibit 9**), and the bluff failure could impact not just the subject parcel but a larger portion of the neighborhood, including several remaining private lots within the subdivision on the west side of Roundhouse Creek Road and the state beach at the base of the bluff (Agate Beach within Patricks Point State Park).

Therefore, the Commission finds that the subject lot is an inherently hazardous piece of property, that the coastal bluff underlying the subject property is highly unstable and erosive, and that the proposed new development could be subject to geologic hazards and potentially someday require a bluff protective device. As discussed in the findings above, the Commission finds that the proposed siting of the new home 151 feet back from the bluff edge is inadequate to assure stability and structural integrity over the economic life of the structure without reliance on construction of shoreline protection, inconsistent with Section 30253.

Given that (1) the Coastal Act requires new development to be sited such that it does not represent a hazard to its owner or occupants, (2) there is a reasonable probability of future sudden, catastrophic bluff collapse, which could affect multiple lots in the neighborhood and impacts to the public beaches below, and (3) Dr. Johnsson recommends monitoring of the bluff to determine when the bluff edge is close enough that the structure can no longer be considered stable, the Commission imposes Special Conditions 2 through 8.

Special Condition 2 declares that the development authorized under this CDP is granted subject to various limitations that the Applicants must agree to, including (in part) the following: (a) conducting annual bluff measurements (distance from authorized development to bluff edge) for the life of the authorized development and submittal of annual measuring results to the Executive Director, and (b) performing more detailed bluff stability analyses when the bluff edge measures 125 feet from the authorized development and again when it measures 76 feet from the authorized development. The Commission finds that it is appropriate to require that a quantitative bluff stability analysis be conducted at the 125-foot setback threshold, because this is consistent with the approach taken by the Humboldt County Building Department in considering when structures in geologically hazardous areas should be evaluated for condemnation. If the development lies within the "angle of repose" (i.e., within 1:1 slope from base of bluff), that is an indication that there is a higher than normal risk to the stability of the structure that warrants a site evaluation by a qualified professional.[18] The Commission further finds that it is appropriate for the analysis to also be conducted at the 76-ft bluff edge setback threshold because that is the distance the Applicants' consulting geologists recommended (with which Dr. Johnsson agreed) is needed to assure stability against sliding today (Dr. Johnsson notes that this figure could change in the future as bluff geometry and exposed soil materials change; see **Exhibit 9**).

Given that the risks of developing a new single family residence on the subject lot cannot be completely eliminated (despite the minimization measures imposed by Special Condition 1), the geologic report cannot assure that shoreline protection will never be needed to protect the

[17] See CDP File 1-98-075 (Wall) and *de minimis* Waiver File 1-99-066-W (Kavich)
[18] Pers. comm., Steve Werner, Supervising Planner, Humboldt County Planning and Building Department (email dated 12/12/13).

proposed new home, and Section 30253 prohibits new development from engendering the need for shoreline protective devices, the Commission imposes **Special Condition 3**. This condition prohibits the construction of shoreline protective devices on the parcel, requires that the landowners remove the authorized structure and its foundation if bluff retreat reaches the point where the structure is threatened, and requires that the landowners accept sole responsibility for the removal of any structural debris resulting from landslides, slope failures, or erosion of the site.

Special Condition 4 requires the preparation of a bluff monitoring and reporting plan for the Executive Director's review and approval. The plan is to be prepared by a Certified Engineering Geologist or Geotechnical Engineer for conducting annual measurements and periodic analyses of bluff stability at and adjacent to the subject site, as required by Special Condition 2. The plan must demonstrate that monuments or points of measurement will be established within 180 days of permit approval to allow the Applicants and/or their successors in interest to conduct annual measurements of the distance between each established monument and the bluff edge. The required plan must also include provisions for the periodic quantitative bluff stability analyses discussed above and submittal of results of annual measurements and analyses to the Executive Director.

Special Condition 1 also requires that final design and construction plans be submitted for the review and approval of the Executive Director that are consistent with the Applicants' geologists' recommendation that the foundation be designed to facilitate the removal of the structure and its foundation in the future. These requirements are necessary for consistency with Section 30253 of the Coastal Act, which states in part that new development shall minimize risk to life and property in areas of high geologic hazard, assure structural integrity and stability, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding areas, nor in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.

The Commission also attaches **Special Condition 6**, which requires the landowners to assume the risks of extraordinary erosion and geologic hazards of the property and waive any claim of liability on the part of the Commission. Given that the Applicants have chosen to implement the project despite these risks, the applicants must assume the risks. In this way, the Applicants are notified that the Commission is not liable for damage as a result of approving the permit for development. The condition also requires the applicants to indemnify the Commission in the event that third parties bring an action against the Commission as a result of the failure of the development to withstand hazards.

Furthermore, **Special Condition 5** requires disclosure of permit conditions and **Special Condition 7** requires the Applicants to record a deed restriction to impose the special conditions of the permit as covenants, conditions and restrictions on the use and enjoyment of the property. These special conditions are required, in part, to ensure that the development is consistent with the Coastal Act and to provide notice of potential hazards of the property and help eliminate false expectations on the part of potential buyers of the property, lending institutions, and insurance agencies that the property is safe for an indefinite period of time and for further development indefinitely into the future, or that a protective device could be constructed to protect the

approved development contrary to the terms and conditions of this permit. By recording the terms and conditions of this permit against the property, future purchasers are notified in advance of their purchase of the limitations on development of the property.

As noted above, some risks of a natural disaster, such as an unexpected landslide, catastrophic bluff failure, significant erosion, etc., could result in destruction or partial destruction of the new single-family residence or other development approved by the Commission. In addition, the development itself and its maintenance may cause future problems that were not anticipated. When such an event takes place, public funds are often sought for the clean-up of structural debris that winds up on the beach or on an adjacent property. As a precaution, in case such an unexpected event occurs on the subject property, **Special Condition 3**, described above, also requires the landowners to accept sole responsibility for the removal of any structural debris resulting from landslides, bluff failures, or erosion on the site and agree to remove the authorized development should the bluff retreat reach the point where a government agency has ordered that these facilities not be used. This requirement is especially important in this case given that there is a state beach (Agate Beach within Patricks Point State Park) at the base of the subject bluff.

The Commission notes that Section 30610(a) of the Coastal Act exempts certain additions to existing single-family residential structures from coastal development permit requirements. Pursuant to this exemption, once a house has been constructed, certain additions and accessory buildings that the applicant might propose in the future are normally exempt from the need for a permit or permit amendment. Depending on its nature, extent, and location, such an addition or accessory structure could contribute to geologic hazards at the site. For example, installing a landscape irrigation system on the property in a manner that leads to saturation of the bluff could increase the potential for landslides or catastrophic bluff failure. Another example would be installing a sizable accessory structure for additional parking, storage, or other uses normally associated with a single family home in a manner that does not provide for the recommended setback from the bluff edge.

Accordingly, Section 30610(a) requires the Commission to specify by regulation those classes of development which involve a risk of adverse environmental effects and require that a permit be obtained for such improvements. Pursuant to Section 30610(a) of the Coastal Act, the Commission adopted Section 13250 of Title 14 of the California Code of Regulations (CCR). Section 13250(b)(6) specifically authorizes the Commission to require a permit for additions to existing single-family residences that could involve a risk of adverse environmental effect by indicating in the development permit issued for the original structure that any future improvements would require a development permit. As noted above, certain additions or improvements to the approved structure could involve a risk of creating geologic hazards at the site. Therefore, pursuant to Section 13250 (b)(6) of Title 14 of the CCR, the Commission attaches **Special Condition 8**, which requires that all future development on the subject parcel that might otherwise be exempt from coastal permit requirements requires an amendment or coastal development permit. This condition will allow future development to be reviewed by the Commission to ensure that future improvements will not be sited or designed in a manner that would result in a geologic hazard. As previously discussed, **Special Condition 7** also requires that the Applicants record and execute a deed restriction approved by the Executive Director against the property that imposes the special conditions of this permit as covenants, conditions

and restrictions on the use and enjoyment of the property. Special Condition 7 will also help assure that future owners are aware of these CDP requirements applicable to all future development.

For all of the above reasons, the Commission concludes that its approval of the proposed development, as conditioned, maximizes Coastal Act consistency while avoiding a "taking," consistent with Coastal Act Section 30010.

As conditioned to require that the property west of the building envelope be restricted to open space and other specific mitigation measures to further minimize geologic hazards as discussed above, the Commission finds that the project will include measures to mitigate all significant adverse environmental effects and geologic hazards to the greatest extent possible consistent while providing for a reasonable use of the property that will avoid an unconstitutional taking of private property for public use.

Furthermore, this particular project involving a bluff-face parcel is unique and unusual and contains conditions specific to this project. Approval of this project would not establish a precedent for the Commission or Humboldt County to approve development on bluff faces for other projects.

I. VISUAL RESOURCES

Section 30251 of the Coastal Act states, in applicable part, as follows:

> *The scenic and visual qualities of coastal areas shall be considered and protected as a resource of public importance. Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character of surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas…*

As previously mentioned, the property is undeveloped and currently vegetated with numerous conifer trees and herbaceous ground cover as well as a strip of invasive Pampas grass (*Cortaderia selloana* and/or *C. jubata*) along the front of the property. Thus, there are limited to no views of the ocean from the public roadway across the property. Public views may be slightly enhanced by the proposed project, which includes the removal of approximately 22 conifer trees (though several conifer trees also will be retained on site). Thus, the proposed new development will be sited and designed to protect views to and along the ocean and scenic coastal areas.

In addition, the property is more or less flat, and the project proposes minimal grading (~35 cubic yards of cut/fill). Therefore, the development as proposed minimizes the alteration of natural land forms. As conditioned to prohibit the construction of shoreline protective devices to protect the approved residence and to require removal and/or relocation of the development when it becomes immediately threatened by bluff retreat, the project as conditioned will avoid the need for future construction of protective devices that would alter the natural bluff landform inconsistent with Section 30251 of the Coastal Act.

Furthermore, the proposed development was reviewed and approved as proposed by the Big Lagoon Design Review Committee. The Committee found the proposed single-story, maximum 15-ft-high development, as proposed, to be visually compatible with the character of the surrounding area. The surrounding area is characterized by mostly developed residential lots with homes similar in scale, materials, and building design to the proposed home, which proposes to use natural stained redwood board and batton siding and "shakewood" shingle roofing (**Exhibit 6**).

Although the surrounding neighborhood is mostly developed with existing homes, the overall nighttime character of the area has relatively minimal exterior lighting evident. Accordingly, to prevent the cumulative impacts of glare to the visual resources of the area, the Commission attaches **Special Condition 9**, which requires that all exterior lighting associated with the proposed development be low-wattage and downcast shielded such that no glare is directed beyond the bounds of the property. The Commission notes that the Applicants have proposed these exterior lighting restrictions on the plans submitted with the application (Exhibit 6).

Therefore, the Commission finds that the proposed project, as conditioned, will protect public views to the ocean, minimize the alteration of natural land forms, and be visually compatible with the character of surrounding area, consistent with Section 30251 of the Coastal Act.

J. PROTECTION OF WATER QUALITY

Section 30230 of the Coastal Act states as follows:

> *Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.*

Section 30231 of the Coastal Act states as follows:

> *The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface water flow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.*

As cited above, Coastal Act Sections 30230 and 30231 require, in part, that marine resources and coastal wetlands and waters be maintained, enhanced, and where feasible restored. These policies specifically call for the maintenance of the biological productivity and quality of marine resources, coastal waters, streams, wetlands, and estuaries necessary to maintain optimum populations of all species of marine organisms and for the protection of human health.

The project site is located on a bluff-top lot above the Pacific Ocean. The proposed development will result in an increase in impervious surface, which in turn will decrease the infiltrative function and capacity of existing permeable land on site. The reduction in permeable space thus leads to an increase in the volume and velocity of stormwater runoff that can be expected to leave the site. Further, pollutants commonly found in runoff associated with residential use include petroleum hydrocarbons such as oil and grease from vehicles; heavy metals; synthetic organic chemicals including paint and household cleaners; soap and dirt from washing vehicles; dirt and vegetation from yard maintenance; litter; fertilizers, herbicides, and pesticides; and bacteria and pathogens from animal waste. The discharge of these pollutants to coastal waters can cause significant adverse cumulative impacts such as: eutrophication and anoxic conditions resulting in fish kills and diseases and the alteration of aquatic habitat, including adverse changes to species composition and size; excess nutrients causing algae blooms and sedimentation increasing turbidity which both reduce the penetration of sunlight needed by aquatic vegetation which provide food and cover for aquatic species; disruptions to the reproductive cycle of aquatic species; and acute and sublethal toxicity in marine organisms leading to adverse changes in reproduction and feeding behavior. Such potential impacts can reduce the biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes and reduce optimum populations of marine organisms and have adverse impacts on human health.

Therefore, in order to find the proposed development consistent with the water quality and marine resource policies of the Coastal Act, the Commission attaches **Special Condition 11**. This condition requires submittal of a final drainage, erosion, and runoff control plan prior to permit issuance for the review and approval of the Executive Director. The plan is required to incorporate design elements and/or Best Management Practices (BMPs) to minimize the volume and velocity of stormwater runoff leaving the developed site and to capture sediment and other pollutants contained in stormwater runoff from the development, by facilitating on-site infiltration and trapping of sediment generated from construction. In addition, to ensure that the project minimizes potential impacts to water quality associated with stormwater runoff and construction practices, the Commission attaches **Special Condition 10**. Thus, as conditioned, the Commission finds that the proposed project will maintain and enhance the functional capacity of the habitat, maintain and restore optimum populations of marine organisms, and protect human health as mandated by the requirements of Sections 30230 and 30231 of the Coastal Act.

K. PROTECTION OF ENVIRONMENTALLY SENSITIVE HABITAT AREAS

Section 30240 of the Coastal Act states as follows:

> *(a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on such resources shall be allowed within such areas.*
>
> *(b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade such areas, and shall be compatible with the continuance of such habitat areas.*

Section 30107.5 of the Coastal Act defines “environmentally sensitive area” as:

> *"…any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments."*

As discussed above in Finding IV-B, there are no wetlands or other known environmentally sensitive habitat areas located on or immediately adjacent to the property. However, it is possible that the existing mature conifer trees on the property, approximately 22 of which are proposed for removal, support seasonal breeding and nesting habitat for birds protected under the state Fish and Game Code and federal Migratory Bird Treaty Act. According to the *Atlas of the Breeding Birds of Humboldt County, California*[19] up to 60 species of birds breed in the terrestrial habitats of the Big Lagoon area.

Tree removal during the bird nesting season (typically March 15 through August 15) could adversely affect sensitive nesting birds such as raptors and various species of migratory birds protected under state and/or federal regulations. To ensure that the proposed tree removal work does not result in significant disruption or degradation of occupied nesting habitat consistent with the requirements of Section 30240 of the Coastal Act, the Commission attaches **Special Condition 12**. This condition restricts the timing of tree removal work to ensure avoidance of any sensitive nesting habitat that may be present during bird breeding and nesting seasons. The condition is consistent with a similar condition imposed by the County on the approved special permit for the project.

Construction of and site preparation for the residential development will create ground disturbance prone to habitation by invasive species, such as Pampas grass (*Cortaderia selloana* and/or *C. jubata*), which occurs along the front of the property adjacent to Roundhouse Creek Road. According to the California Department of Fish and Wildlife,[20] Pampas grass is an aggressive weed that is capable of rapidly colonizing disturbed areas and degrading natural habitats:

> *Pampas grass is a quickly growing grass that forms massive clumps along roadsides, steep cliffs, river banks, and open areas that have been disturbed by human activities or natural disturbances. Introduced to Santa Barbara, California in 1848 by nursery operators, pampas grass has spread all over the state, threatening native plants and the animals that rely on them.*
>
> *An individual pampas grass stand can produce millions of seeds annually that travel several miles, and because these grasses are very tolerant of intense sunlight, drought, and frost, they are very efficient at establishing in many habitat types. Due to the fact that pampas grass can live over a decade, it has become a favorable plant for people to grow in their gardens.*
>
> *Invasive plants such as pampas grass displace native plants and create habitats that are lower in biodiversity. Furthermore, pampas grass has leaf blades that are*

[19] Hunter, J.E. et al. 2005. *Atlas of the Breeding Birds of Humboldt County, California*. Redwood Region Audubon Society. Eureka, CA.

[20] http://www.dfg.ca.gov/habcon/plant/dontplantme/cortaderia.html

> *highly undesirable as food or shelter to birds and other wildlife, and can actually cause physical harm to those animals, including humans, because the leaves are extremely sharp. Therefore, it is important that we do our part by not planting pampas grass in our gardens, but instead plant native plants that are comparably beautiful and provide the same utility.*

Accordingly, the Commission imposes **Special Condition 13**, which requires the Applicants to remove existing weedy grass within 100 feet of the authorized development on the subject parcel to avoid the spread and proliferation of invasive weeds into disturbed areas and surrounding ESHA and park and recreation areas. This Special Condition further requires a 5-year monitoring plan to ensure the native plants take and invasives identified within the boundaries of the property are promptly removed and replaced with native species as proposed.

In addition, Special Condition 13 also requires that only native and/or non-invasive plant species be planted and used in erosion-control seeding on the subject property. This requirement is consistent with the Applicants' proposal, which includes a landscaping plan (**Exhibit 6**) that proposes a variety of native, regionally appropriate species such as deer fern, twinberry, western azalea, and others. The Commission finds that the adjacent park and recreation area, which contains wetlands and other environmentally sensitive habitats, could be adversely affected if nonnative, invasive plant species were introduced in landscaping or erosion control seeding at the subject site. If any of the proposed landscaping or seeding were to include introduced invasive exotic plant species, the weedy plants could colonize (e.g., via wind or wildlife dispersal) the nearby park and recreation area over time, displace native vegetation, and significantly degrade the recreation area and the functions and values of its natural habitats.

Special Condition 13 further includes a provision prohibiting the use of certain anticoagulant-based rodenticides that are known to pose significant primary and secondary risks to non-target wildlife present in urban and urban/wildland interface areas. As property owners sometimes use such pesticides to prevent wild critters from grazing on landscaping and other vegetation, and as these target species commonly are preyed upon by raptors or other environmentally sensitive predators and scavengers, the pest control compounds can bio-accumulate in the animals that have consumed the rodents to concentrations toxic to the ingesting non-target species. Thus, Special Condition 13-d is intended to avoid this potential cumulative impact to environmentally sensitive wildlife species. The Commission notes that the Applicants have proposed these landscaping restrictions on the plans submitted with the application (**Exhibit 6**).

The Commission thus finds that as conditioned, the project will not result in significant disruption or degradation of ESHA consistent with Section 30240 of the Coastal Act.

L. PROTECTION OF ARCHAEOLOGICAL RESOURCES

Section 30244 of the Coastal Act states as follows:

> *Where development would adversely impact archeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required.*

The project site is located within the ancestral lands of the Yurok Tribe. In its processing of the required special permit for the proposed project, Humboldt County referred the project to the North Coast Information Center, Trinidad Rancheria, Yurok Tribe, and other associated local tribes. The County's special permit includes a requirement to halt ground-disturbing activities in the event that archaeological resources are inadvertently discovered during construction. Similarly, to ensure protection of any archaeological resources that may be discovered at the site during excavation for the proposed new residence consistent with Section 30244, the Commission requires **Special Condition 14**. This condition directs that if an area of archaeological deposits is discovered during the course of the authorized development, all construction must cease, and a qualified archaeologist must analyze the significance of the find. To recommence construction following discovery of cultural deposits, the applicant is required to submit a supplementary archaeological plan for the review and approval of the Executive Director, prepared in consultation with the Yurok Tribe and/or other appropriate tribal representatives, to determine whether the changes are *de minimis* in nature and scope, or whether an amendment to this permit is required.

Thus, the Commission finds that the proposed development, as conditioned, is consistent with Coastal Act Section 30244, as the development will include mitigation measures to ensure that the development will not adversely impact archaeological resources.

M. PUBLIC ACCESS

Coastal Act Sections 30210, 30211, and 30212 require the provision of maximum public access opportunities, with limited exceptions. Coastal Act Section 30210 requires in applicable part that maximum public access and recreational opportunities be provided when consistent with public safety, private property rights, and natural resource protection. Section 30211 requires in applicable part that development not interfere with the public's right of access to the sea where acquired through use (i.e., potential prescriptive rights or rights of implied dedication). Section 30212 requires in applicable part that public access from the nearest public roadway to the shoreline and along the coast be provided in new development projects, except in certain instances, such as when adequate access exists nearby or when the provision of public access would be inconsistent with public safety. In applying Sections 30211 and 30212, the Commission is limited by the need to show that any denial of a permit application based on these sections or any decision to grant a permit subject to special conditions requiring public access is necessary to avoid or offset a project's adverse impact on existing or potential public access.

Public access to nearby beach and shoreline areas includes an informal trail to Agate Beach, in Patricks Point State Park, located about a third of a mile south, beyond the end of Roundhouse Creek Road, and informal access to the Big Lagoon County Park beach approximately a quarter of a mile to the north, near the bluff failure area at the north end of Ocean View Drive. In addition, Big Lagoon County Park, which includes beach access, boating access to the lagoon, and a campground, is located less than a mile north of the property.

There is no evidence of public use of the subject property for public access, no evidence of trails on the property, and no indication from the public that the site has been used for public access purposes in the past. As previously described, the subject lot is situated on a bluff-top parcel with existing single family residences located between the property and the steep, ~125-ft-high bluff

face. The proposed development will not significantly or adversely increase the demand for public access to the shoreline, as it involves developing an existing single family residential lot for only one residence. For all of these reasons, the Commission finds that the proposed project, which does not include provision of public access, is consistent with the public access policies of the Coastal Act.

N. LOCAL COASTAL PROGRAM

Section 30604(a) of the Coastal Act states as follows:

> *(a) Prior to certification of the Local Coastal Program, a coastal development permit shall be issued if the issuing agency, or the commission on appeal, finds that the proposed development is in conformity with the provisions of Chapter 3 (commencing with Section 30200) of this division and that the permitted development will not prejudice the ability of the local government to prepare a Local Coastal Program that is in conformity with the provisions of Chapter 3 (commencing with Section 30200). A denial of a coastal development permit on grounds it would prejudice the ability of the local government to prepare a Local Coastal Program that is in conformity with the provisions of Chapter 3 (commencing with Section 30200) shall be accompanied by a specific finding which sets forth the basis for such conclusion.*

This section of the Act provides that the Commission shall issue a CDP only if the project will not prejudice the ability of the local government having jurisdiction to prepare an LCP that conforms with the Chapter 3 policies of the Coastal Act.

The area that includes the subject site and all of the lots in the Big Lagoon Estates Subdivision that are locally planned and zoned for residential use and located on the west side of Roundhouse Creek Road and Ocean View Drive lacks a certified LCP. As conditioned, the proposed development will be consistent with Chapter 3 of the Coastal Act, and approval of the project will not prejudice the ability of Humboldt County to prepare a LCP for this area that is in conformity with the provisions of Chapter 3 of the Coastal Act.

O. REIMBURSEMENT OF COSTS AND FEES

Coastal Act section 30620(c)(1) authorizes the Commission to require applicants to reimburse the Commission for expenses incurred in processing CDP applications. See also 14 C.C.R. § 13055(g). Thus, the Commission is authorized to require reimbursement for expenses incurred in defending its action on the pending CDP application. Therefore, consistent with Section 30620(c), the Commission imposes **Special Condition 15** requiring reimbursement of any costs and attorneys' fees the Commission incurs in connection with the defense of any action brought by a party other than the Applicant/Permittee challenging the approval or issuance of this permit, the interpretation and/or enforcement of permit conditions, or any other matter related to this permit.

P. CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Humboldt County served as the lead agency for the project for CEQA purposes. The County determined that the project qualified for a CEQA categorical exemption under Class 3, Section 15303(a) of CEQA Guidelines.

Section 13906 of the Commission's administrative regulation requires Coastal Commission approval of coastal development permit applications to be supported by a finding showing the application, as modified by any conditions of approval, is consistent with any applicable requirements of the California Environmental Quality Act (CEQA). Section 21080.5(d)(2)(A) of CEQA prohibits a proposed development from being approved if there are any feasible alternatives or feasible mitigation measures available, which would substantially lessen any significant adverse effect the proposed development may have on the environment.

The Commission incorporates its findings on Coastal Act consistency at this point as if set forth in full. As discussed above, the proposed project has been conditioned to be consistent with the policies of the Coastal Act to the maximum extent feasible consistent with Section 30010 of the Coastal Act. The findings address and respond to all public comments regarding potential significant adverse environmental effects of the project that were received prior to preparation of the staff report. As specifically discussed in these above findings, which are hereby incorporated by reference, mitigation measures that will minimize or avoid all significant adverse environmental impacts to the extent feasible have been required. As conditioned, there are no other feasible alternatives or feasible mitigation measures available which would substantially lessen any significant adverse impacts consistent with the requirements of Section 30010. Therefore, the Commission finds that the proposed project, as conditioned to mitigate the identified impacts, can be found consistent with the requirements of the Coastal Act to conform to CEQA.

APPENDIX A: SUBSTANTIVE FILE DOCUMENTS

1. Application file for CDP 1-12-023 (Winget)
2. Application files for CDPs **1-12-013** (Wilson), **1-10-010** (Maier), **A-1-MEN-09-023** (Wernette), **1-03-027-G** and **CDP 1-03-028** (Rohner), **1-99-066-W** (Kavich), **1-98-075** (Wall), **1-93-012** (Matheson), **1-91-204** (Campbell), **1-90-142** (Lansing), **1-87-230** (Kavich), **1-85-200** (Donohoe), **1-85-130** (Haddock), **1-84-222** (Big Lagoon Park Company), **NCR-78-CC-942** (Stanley), **NCR-77-CC-257** (Headington), **NCR-75-CC-449** (White), **NCR-74-CC-344** (Rohner), **NCR-74-CC-322** (Rochlin), and **NCR-74-CC-283** (Dickerson)
3. California Coastal Commission Draft Sea-Level Rise Policy Guidance, Public Review Draft, October 14, 2013.
4. National Research Council (NRC), Committee on Sea Level Rise in California, Oregon, and Washington. 2012. Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future. National Academies Press, Washington, D.C. pp.250. ISBN 978-309-24494-3.
5. Revell, D.L., Battalio, R., Spear, B., Ruggiero, P., & Vandever, J. 2011. A Methodology for predicting future coastal hazards due to sea-level rise on the California coast. Climatic Change, 109(Suppl 1), 251-276. DOI 10.1007/s10584-011-0315-2.
6. Heberger, M., Cooley, H., Herrera, P., Gleick, P. H., & Moore, E. 2009. The Impacts of Sea-level Rise on the California Coast. Prepared by the Pacific Institute for the California Climate Change Center.
7. Johnsson, M. 2005. Establishing Development Setbacks from Coastal Bluffs. California and the World Ocean '02, pp. 396-416. doi: 10.1061/40761(175).
8. Hwang, D. J. 2005. Hawaii Coastal Hazard Mitigation Guidebook. University of Hawaii Sea Grant College Program, pp. 216, ISBN 10-1929054025.
9. Griggs et al. 1992. California's Coastal Hazards: A Critical Assessment of Existing Land-use Policies and Practices
10. Chaney, R.C. and D.C. Tuttle. 1988. Coastal Bluff Retreat at Big lagoon, California. Proceedings: Second International Conference on Case Histories in Geotechnical Engineering, June 1-5, 1988, St. Louis, Mo., Paper No. 3.40
11. Humboldt County General Plan 2014 Draft Housing Element
12. Humboldt County Special Permit 12-029 approved on 10/16/13
13. County of Humboldt Local Coastal Program

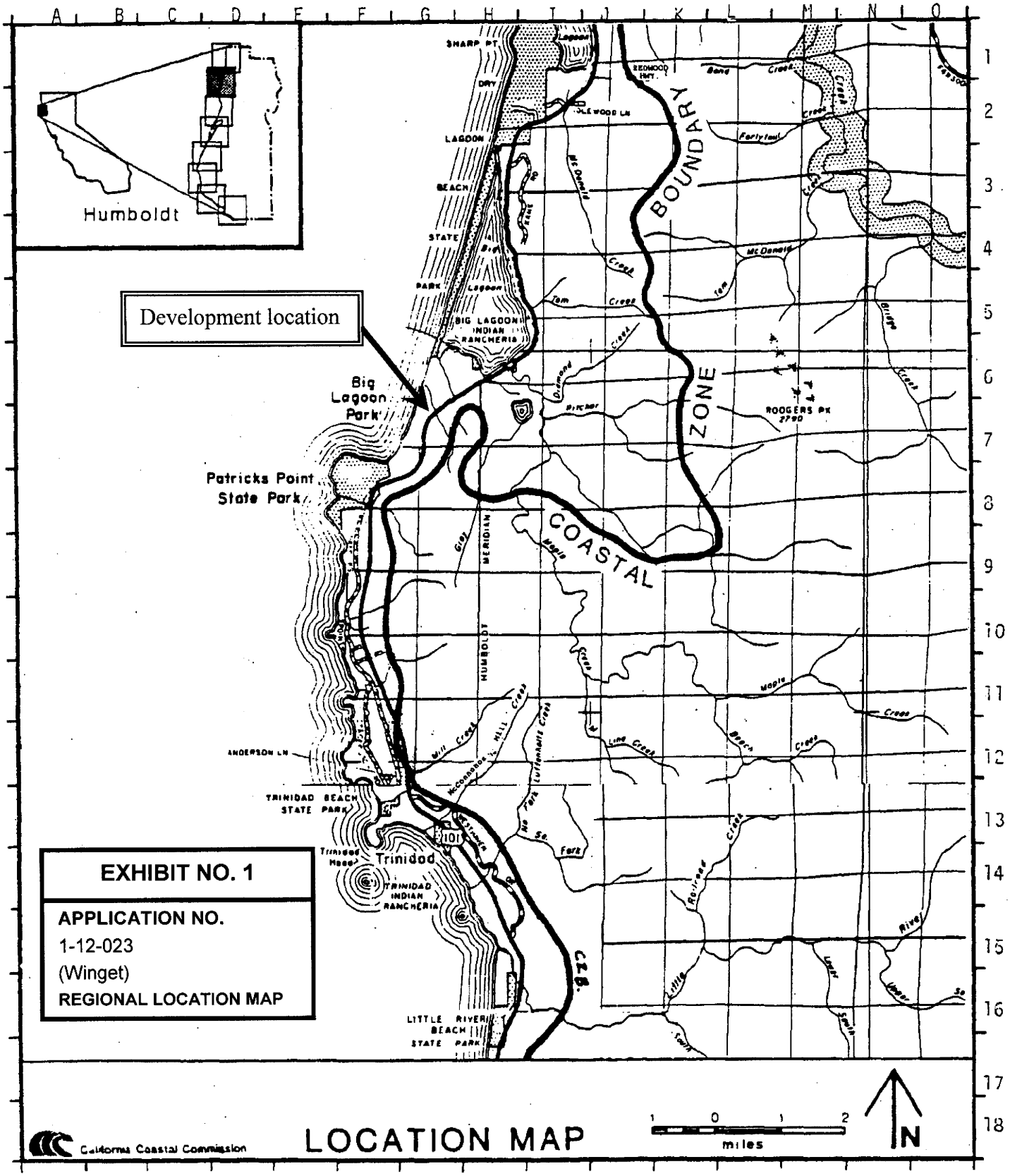


EXHIBIT NO. 1

APPLICATION NO.
1-12-023
(Winget)
REGIONAL LOCATION MAP

County of Humboldt

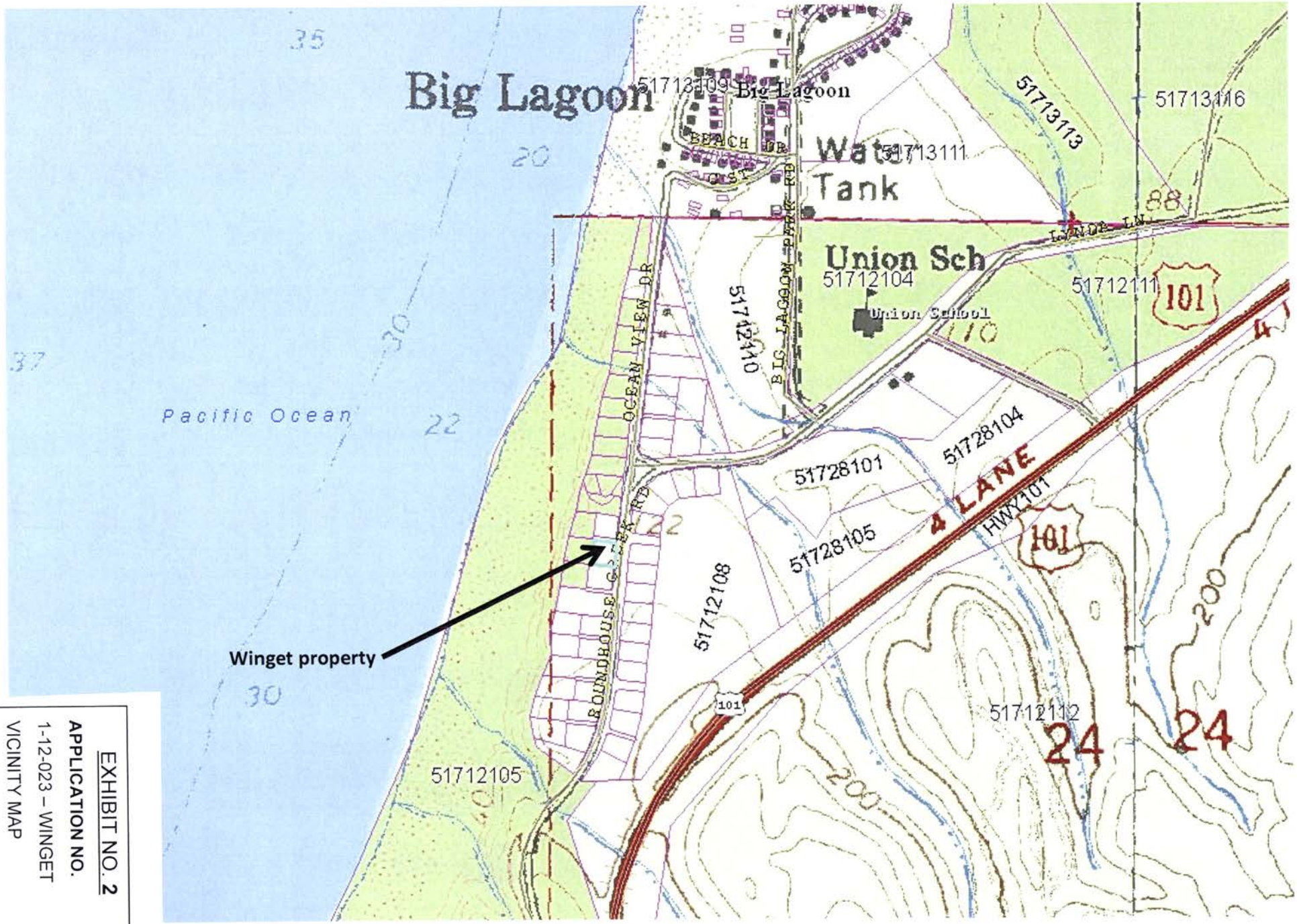


EXHIBIT NO. 2

APPLICATION NO.

1-12-023 – WINGET

VICINITY MAP

EXHIBIT NO. **3**

APPLICATION NO.

1-12-023 – WINGET

2012 AERIAL PHOTO

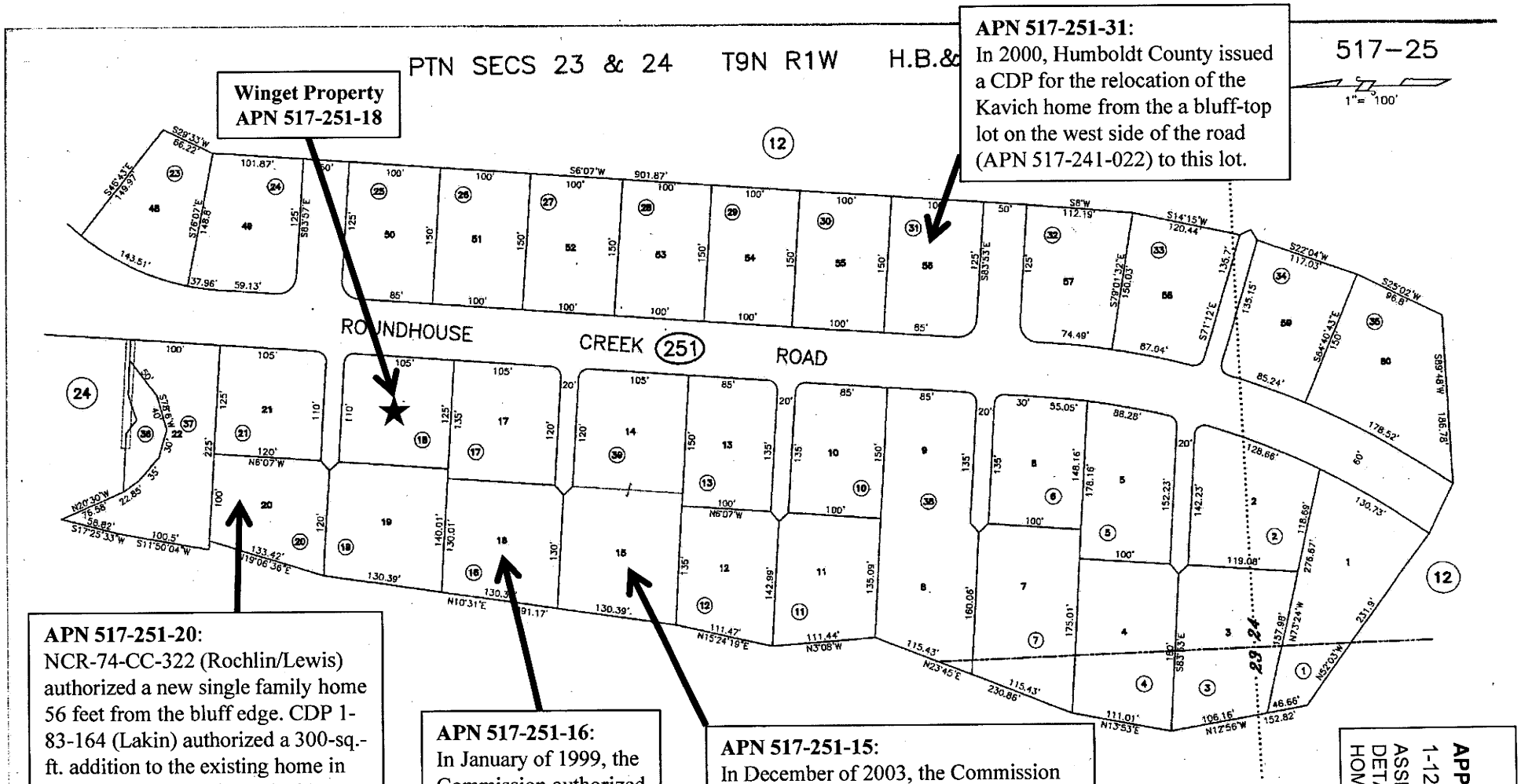


EXHIBIT NO. 4

APPLICATION NO.

1-12-023 – WINGET

ASSESSOR'S PARCEL MAP WITH DETAILS ON SURROUNDING HOME REMOVALS (1 of 2)

SEC 24, 9N 1W

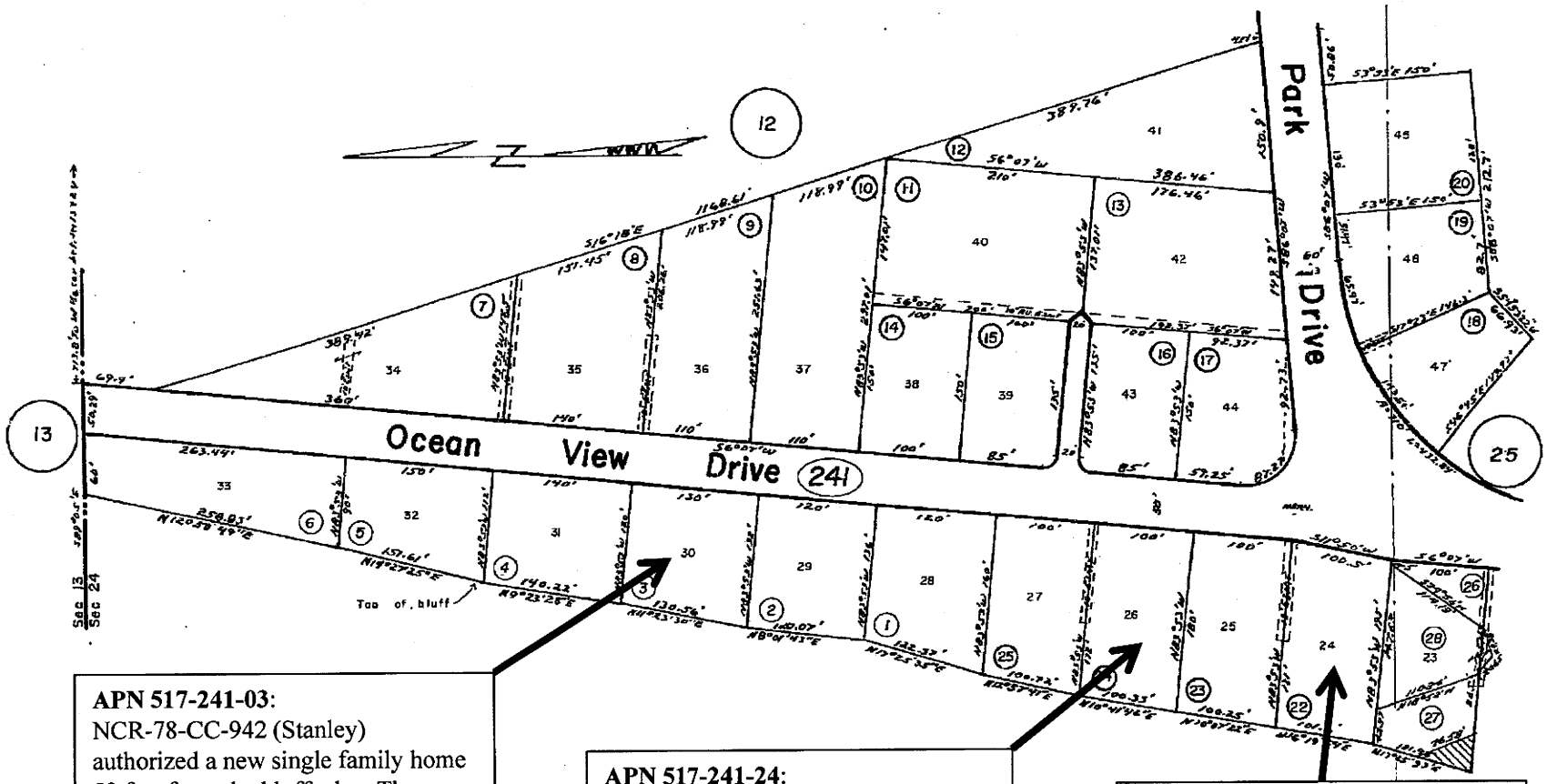
(BIG LAGOON PARK SUBDVN., TRACT 22, BLK. A.)

517-24

1" = 100'

8/31/62

LS 8p 10
Maps 14p25,26



APN 517-241-03:
NCR-78-CC-942 (Stanley) authorized a new single family home 58 feet from the bluff edge. The home was removed due to bluff retreat hazards some time between 1987 and 2002 (according to aerial photos; no permit records are on file regarding the removal).

APN 517-241-24:
NCR-77-CC-257 (Headington) authorized a new single family home 80 feet from the bluff edge. The home had to be removed and rebuilt on a lot across the street in 1998 (under County CDP 60-97) due to bluff retreat hazards.

APN 517-241-22:
CDP 1-87-230 (Kavich) authorized a new single family home over 100 feet from the bluff edge. The home had to be removed and relocated due to bluff retreat in 1999 (de minimis waiver 1-99-066-W).

2 of 2

EXHIBIT NO. **5**
APPLICATION NO.
1-12-023 – WINGET
AERIAL PHOTOS
1972-2013 (1 of 5)

Photo Year: 1972

Photo Year: 1979

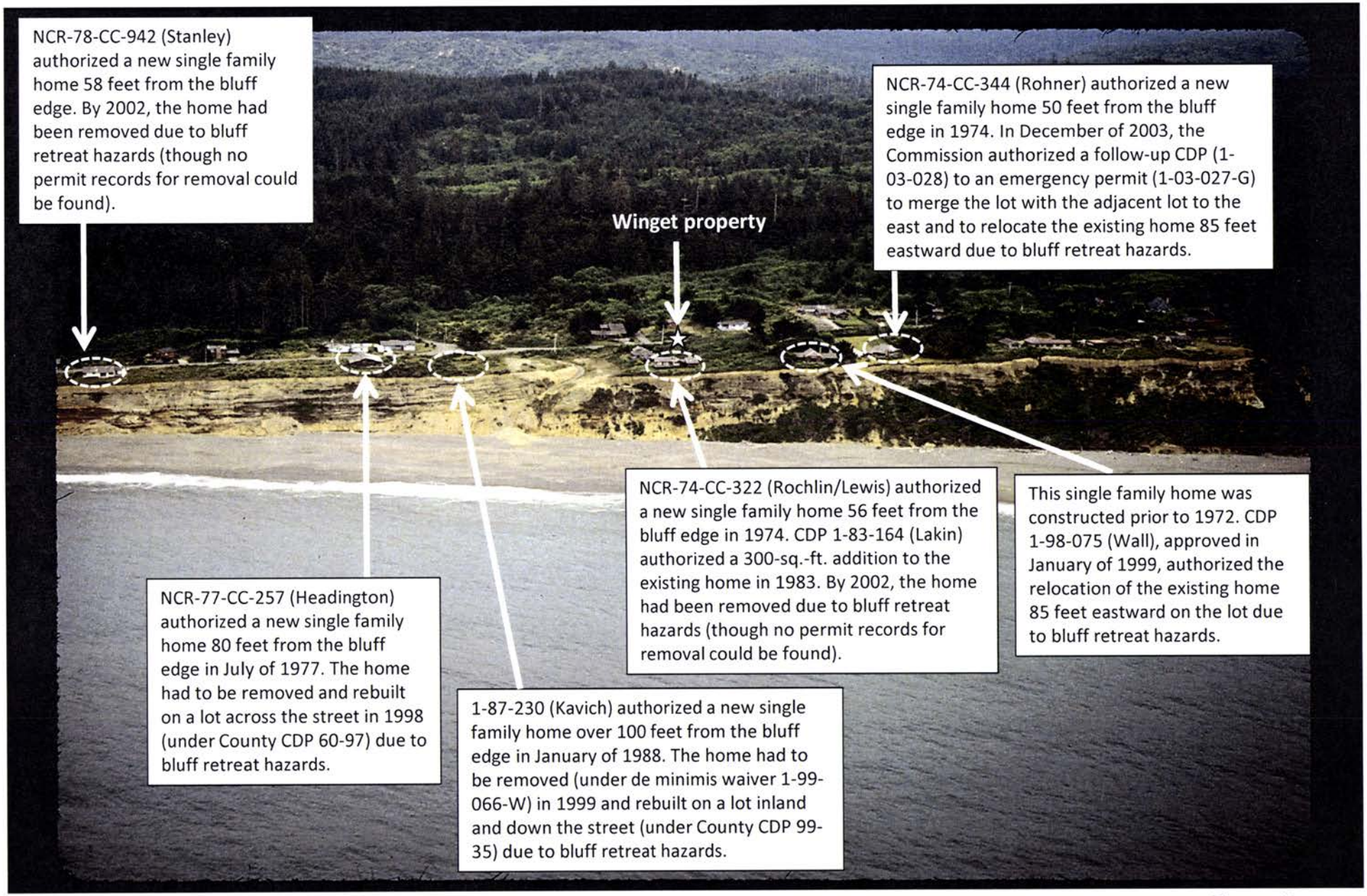


Photo Year: 1987

3 of 5

Photo Year:
2002

4 of 5

Photo Year: 2013

5 of 5

COASTAL DEVELOPMENT PERMIT APPLICATION
254 ROUND HOUSE CREEK ROAD, BIG LAGOON, HUMBOLDT COUNTY, CALIFORNIA
ASSESSORS PARCEL NUMBER 517-251-018

SHEET INDEX

LEGEND

- MB <E> MAIL BOX
- PB <E> UTILITY PULL BOX
- <E> CONTROL POINT
- <E> TREE
- <E> FOUND MONUMENT
- <E> GRAVEL
- EL <E> ELECTRICAL LINE
- TV <E> CABLE LINE
- W <E> WATER LINE
- <E> EDGE OF BLUFF
- <E> PROPERTY LINE
- <E> SETBACK
- BF <P> BACKFLOW PREVENTER
- WM <P> WATER METER
- <P> GRAVEL
- <P> GRASS
- UG E <P> ELECTRICAL LINE
- TV <P> CABLE LINE
- W <P> WATER LINE
- G <P> GAS LINE
- <P> LEACHLINE

GENERAL NOTES:

1. THE ELEVATIONS FOR THIS SURVEY ARE ASSUMED. THE PROJECT BENCHMARK IS A MAG NAIL AND SURVEY DISK SHOWN HEREON AS CP106, ASSUMED ELEVATION IS 987.13'.
2. THE UNDERGROUND UTILITY LOCATIONS SHOWN HEREON WERE BASED ON VISIBLE EVIDENCE. THEREFORE LACO ASSOCIATES ASSUMES NO LIABILITY FOR THE LOCATION OR EXISTENCE OF UTILITIES THAT MAY NOT HAVE BEEN VISIBLE AT THE TIME OF THIS SURVEY. LACO ASSOCIATES MAKES NO GUARANTEE THAT THE UNDERGROUND UTILITIES SHOWN HEREON ARE A COMPREHENSIVE REPRESENTATION OF ALL UTILITIES WITHIN THESE MAPPING LIMITS, EITHER IN SERVICE OR ABANDONED.
3. ONLY TREES LARGER THAN 12" DBH WERE LOCATED DURING THIS SURVEY AS REQUIRED BY THE COUNTY OF HUMBOLDT FOR PERMITTING PURPOSES. SEVERAL TREES SMALLER THAN 12" DBH, 1-18" AND 1-24" SPRUCE WILL BE REMOVED WITHIN BUILDING PAD AND DRIVEWAY AREAS (APPROXIMATELY 2620 SF).
4. THIS MAP IS BASED ON A PARTIAL SURVEY CONDUCTED BY LACO ASSOCIATES ON AUGUST 12, 2010. THE BOUNDARY INFORMATION SHOWN DIFFERS FROM THE INFORMATION SHOWN ON RECORD MAPS. A RECORD OF SURVEY WILL BE FILED TO ILLUSTRATE THESE DIFFERENCES.
5. CONSTRUCTION WORK SHALL:
   A. USE DUST CONTROL TECHNIQUES WHEN EXCAVATING TO MINIMIZE DUST PROBLEMS ON ADJACENT DWELLING(S).
   B. RESEED DISTURBED AREAS PRIOR TO WINTER RAIN WITH NATIVE SEED MIX.
   C. TAKE ALL PRECAUTIONS NECESSARY TO AVOID THE ENCROACHMENT OF DIRT OR DEBRIS ON ADJACENT PROPERTIES.

   ALL GROUND BARED DURING CONSTRUCTION SHALL BE LANDSCAPED AND/OR SEEDED AND MULCHED PRIOR TO OCTOBER 1ST. COMPLIANCE WITH THIS CONDITION SHALL BE VERIFIED BY THE BUILDING INSPECTION DIVISION.
6. CONSTRUCTION SHALL CONFORM TO ALL RECOMMENDATIONS AND REQUIREMENTS CONTAINED IN THE APPROVED ENGINEERING GEOLOGIC/FOUNDATION AND SOILS REPORT PREPARED BY LACO DATED DECEMBER 16, 2011 AND BUSCH GEOTECHNICAL DATED NOVEMBER 06 2006, AND SEWAGE DISPOSAL SYSTEM DESIGN BY LACO ASSOCIATES DATED DECEMBER 16, 2011.
7. ALL PARKING REQUIRED BY CODE MUST BE CONSTRUCTED ON-SITE. ALL PARKING MUST BE CONSTRUCTED PRIOR TO CERTIFICATE OF OCCUPANCY FOR THE BUILDING.
8. ALL EXTERIOR LIGHTS, INCLUDING ANY LIGHTS ATTACHED TO THE OUTSIDE OF THE BUILDINGS, SHALL BE THE MINIMUM NECESSARY FOR THE SAFE INGRESS, EGRESS, AND USE OF THE STRUCTURES, AND SHALL BE LOW-WATTAGE, NON-REFLECTIVE, SHIELDED, AND HAVE A DIRECTIONAL CAST DOWNWARD SUCH THAT NO LIGHT WILL BE DIRECTED TO SHINE BEYOND THE BOUNDARIES OF THE SUBJECT PARCEL.
9. VEGETATION AT THE SITE SHALL BE MAINTAINED TO THE MAXIMUM EXTENT POSSIBLE, AND ANY DISTURBED AREAS SHALL BE REPLANTED OR SEEDED WITH NATIVE VEGETATION.
10. LANDSCAPING RESTRICTIONS:
    A. NO PLANT SPECIES LISTED AS PROBLEMATIC AND/OR INVASIVE BY THE CALIFORNIA NATIVE PLANT SOCIETY, THE CALIFORNIA INVASIVE PLANT COUNCIL, OR AS MAY BE IDENTIFIED FROM TIME TO TIME BY THE STATE OF CALIFORNIA, SHALL BE EMPLOYED OR ALLOWED TO NATURALIZE OR PERSIST ON THE SITE. NO PLANT SPECIES LISTED AS A "NOXIOUS WEED" BY THE GOVERNMENTS OF THE STATE OF CALIFORNIA OR THE UNITED STATES SHALL BE UTILIZED WITHIN THE PROPERTY.
    B. RODENTICIDES CONTAINING ANY ANTICOAGULANT COMPOUNDS, INCLUDING BUT NOT LIMITED TO, BROMADIOLONE, BRODIFACOUM, OR DIPHACINONE, SHALL NOT BE UTILIZED WITHIN THE PROPERTY.

LOCATION MAP
N.T.S.

AREA MAP
N.T.S.

VICINITY MAP
AS SHOWN

APPROXIMATE GRADING QUANTITIES
35 CU CUT/FILL

EXHIBIT NO. 6
APPLICATION NO.
1-12-023 – WINGET
PROJECT PLANS
(1 of 9)

LACO
EUREKA • UKIAH • SANTA ROSA
1-800-515-5954 www.lacoassociates.com

NO.	HISTORY / REVISION	BY	CHK	DATE

COASTAL DEVELOPMENT PERMIT APPLICATION
TITLE SHEET
DALE & LEI WINGET
254 ROUND HOUSE CREEK ROAD, BIG LAGOON, CA.

DRAWN	JB/JDB
CHECK	RLD/EEB
APPROVED	MDN
DATE	7/31/13
JOB NUMBER	7473.00
SHEET	1

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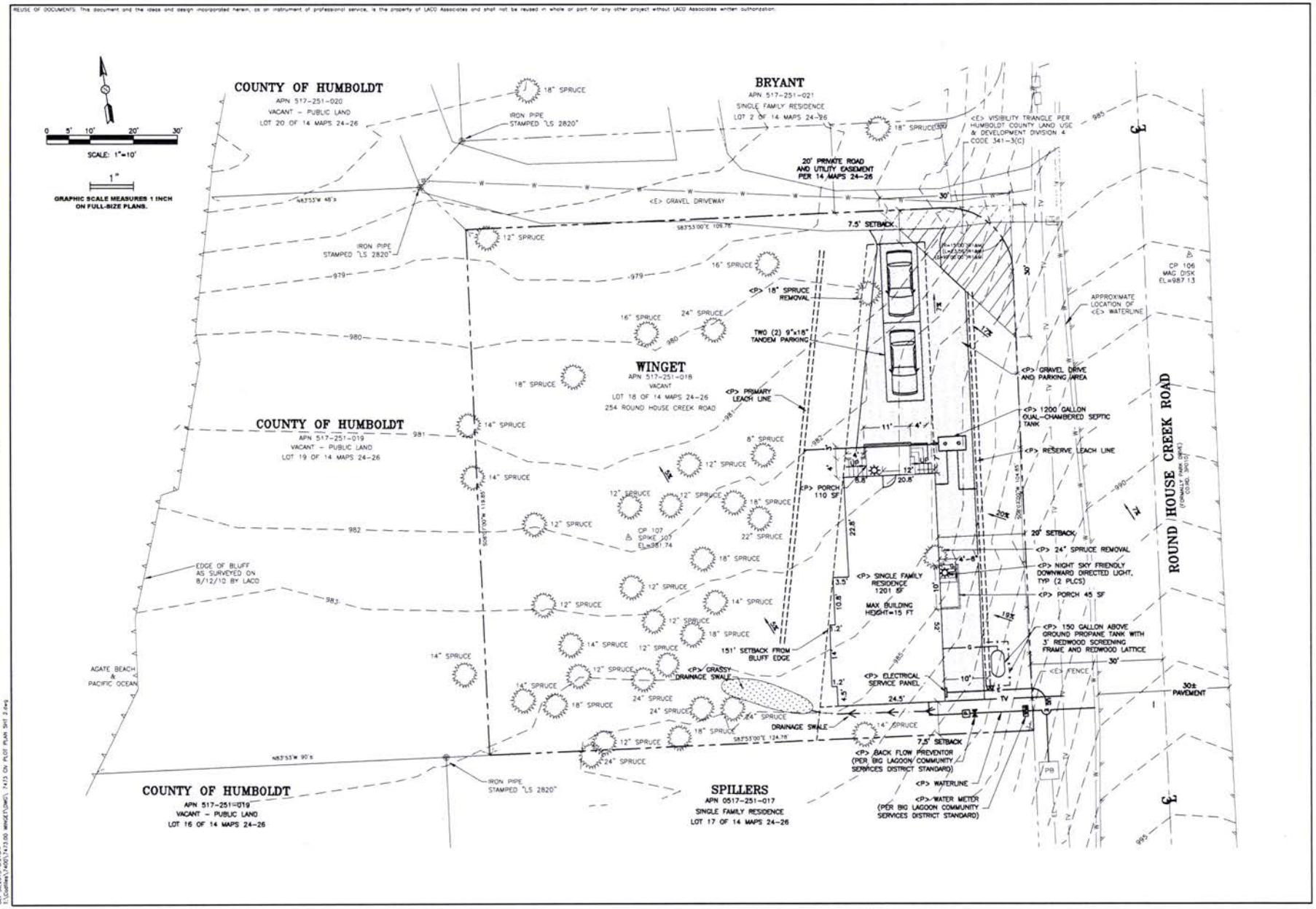

LACO
EUREKA • UKIAH • SANTA ROSA
1-800-315-5654 www.lacoassociates.com

NO.	HISTORY / REVISION	BY	CHK.	DATE

COASTAL DEVELOPMENT PERMIT APPLICATION

PLOT PLAN

DALE & LEI WINGET
254 ROUND HOUSE CREEK ROAD, BIG LAGOON, CA.

DRAWN	JB/JDB
CHECK	RLD/EEB
APPROVED	MDN
DATE	7/31/13
JOB NUMBER	7473.00
SHEET	2

Oct 30,2013-8:37am
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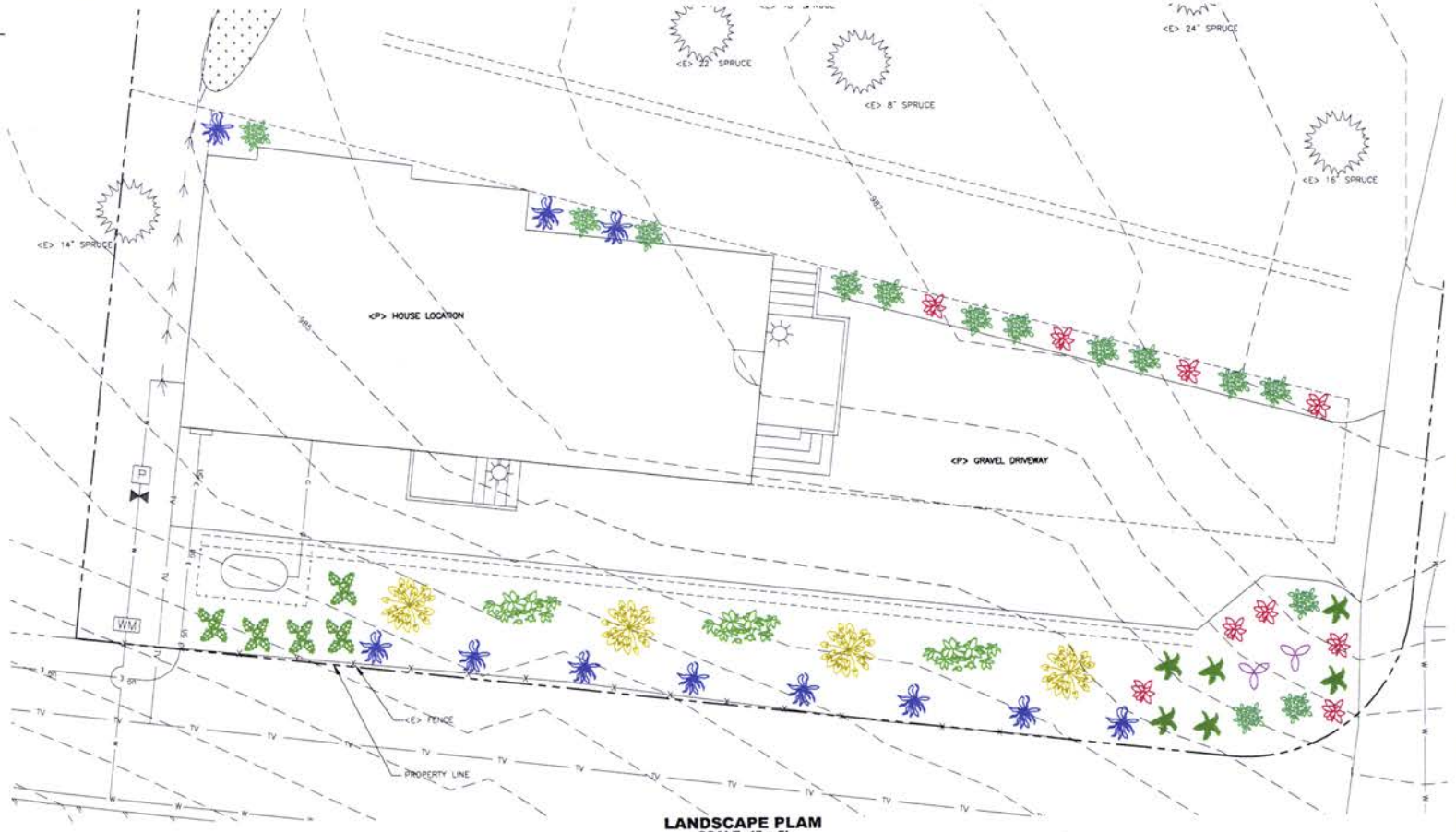
284

LEGEND

- DEER FERN
- PURPLE ASTER
- DOUGLAS'S IRIS
- FALSE LILY OF THE VALLEY
- BEACH STRAWBERRY
- TWINBERRY
- WESTERN AZALEA
- SALAL
- TREE (EXISTING)

1"

GRAPHIC SCALE MEASURES 1 INCH ON FULL-SIZE PLANS.



LANDSCAPE PLAM
SCALE: 1" = 5'

PLANT LIST				
COMMON NAME	FORMAL NAME	TYPE	AMOUNT	SIZE
DEER FERN	BLECHNUM SPICANT	PERENNIAL	6	1 GAL.
PURPLE ASTER	SYMPHYOTRICHUM CHILENSIS	PERENNIAL	2	4 INCH
DOUGLAS'S IRIS	IRIS DOUGLASIANA	PERENNIAL	14	4 INCH
FALSE ILIY OF THE VALLEY	MAIANTHEMUM DILATATUM	PERENNIAL	11	4 INCH
BEACH STRAWBERRY	FRAGARIA CHILENSIS	PERENNIAL	9	1 GAL.
SALAL	GAULTHERIA SHALLON	SHRUB	5	1 GAL.
TWINBERRY	LONICERA INVOLUCRATA	SHRUB	3	1 GAL.
WESTERN AZALEA	RHODODENDRON OCCIDENTALE	SHRUB	4	1 GAL.
		TOTAL	54	

DRAFT

LACO
EUREKA • UKIAH • SANTA ROSA
t-800-515-5054 www.lacoassociates.com

NO.	HISTORY / REVISION	BY	CHK	DATE

COASTAL DEVELOPMENT PERMIT APPLICATION

PRELIMINARY LANDSCAPE PLAN

DALE & LEI WINGET
254 ROUND HOUSE CREEK ROAD, BIG LAGOON, CA.

DRAWN	JB/JDB
CHECK	RLD/EEB
APPROVED	MDN
DATE	7/31/13
JOB NUMBER	7473.00
SHEET	3

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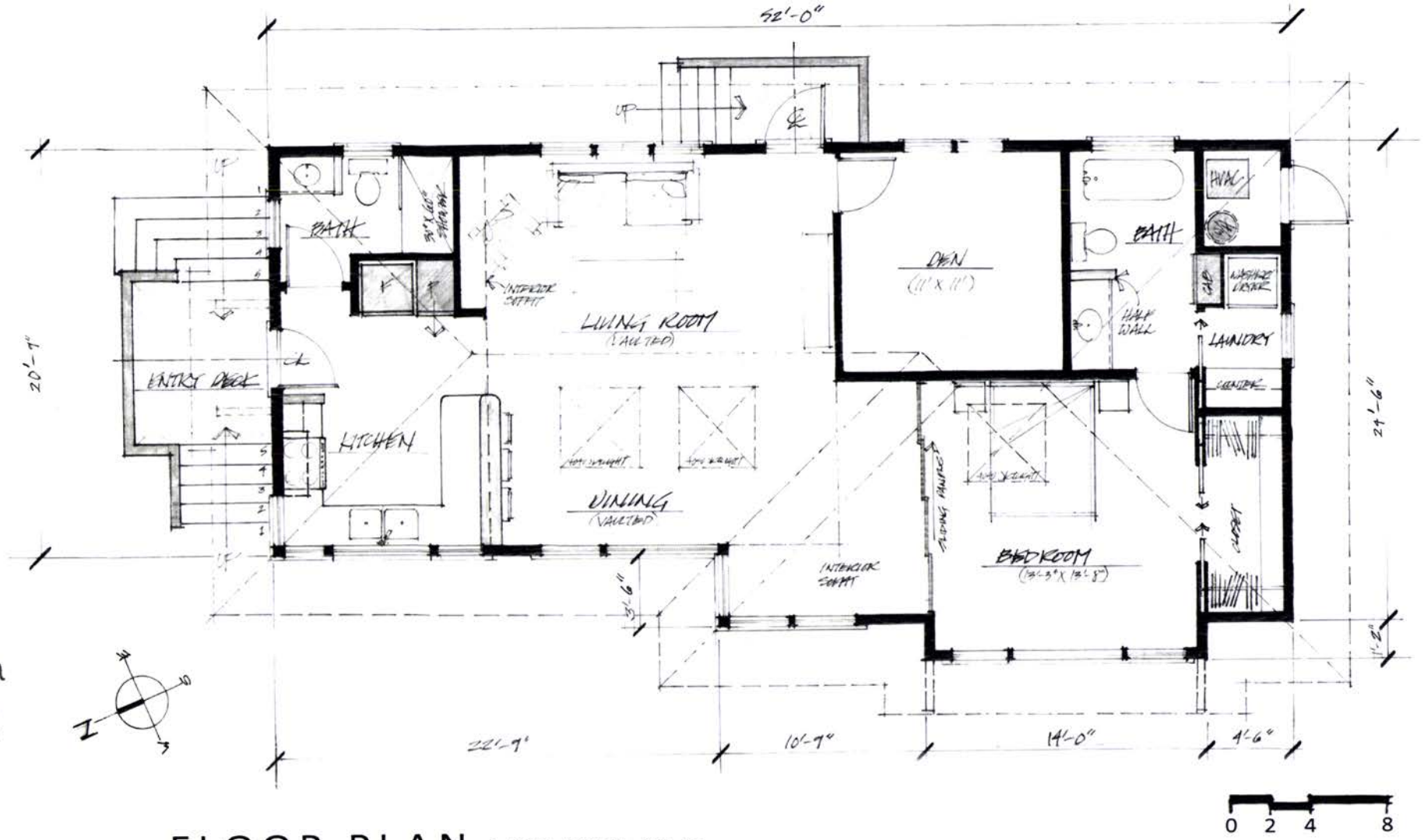
6 of 9

COLOR SITE PLAN

7.18.12

WINGET RESIDENCE
254 ROUND HOUSE CREEK ROAD
BIG LAGOON, CALIFORNIA

LACO ASSOCIATES
ENGINEERS · GEOLOGISTS · ENVIRONMENTAL CONSULTANTS
21 W. 4th St. · PO Box 1023 · Eureka, CA 95502 · 707.443.5054



FLOOR PLAN 1,201 TOTAL SQ FT

7.18.12

WINGET RESIDENCE

254 ROUND HOUSE CREEK ROAD
BIG LAGOON, CALIFORNIA

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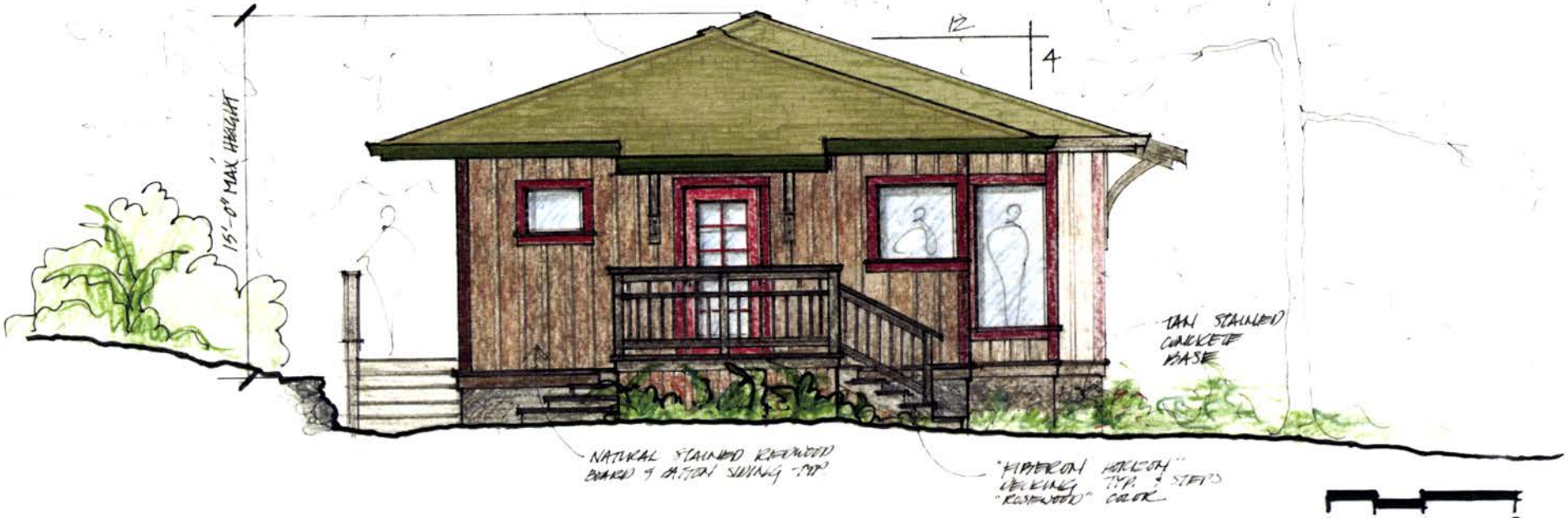
21 W. 4th St. · PO Box 1023 · Eureka, CA 95502 · 707.443 5054

5 of 9

6 of 9



NORTH ELEVATION

7.18.12

WINGET RESIDENCE
254 ROUND HOUSE CREEK ROAD
BIG LAGOON, CALIFORNIA

LACO ASSOCIATES
ENGINEERS · GEOLOGISTS · ENVIRONMENTAL CONSULTANTS
21 W. 4th St. · PO Box 1023 · Eureka, CA 95502 · 707.443.5054

0 2 4 8

EAST ELEVATION

7.18.12

WINGET RESIDENCE
254 ROUND HOUSE CREEK ROAD
BIG LAGOON, CALIFORNIA

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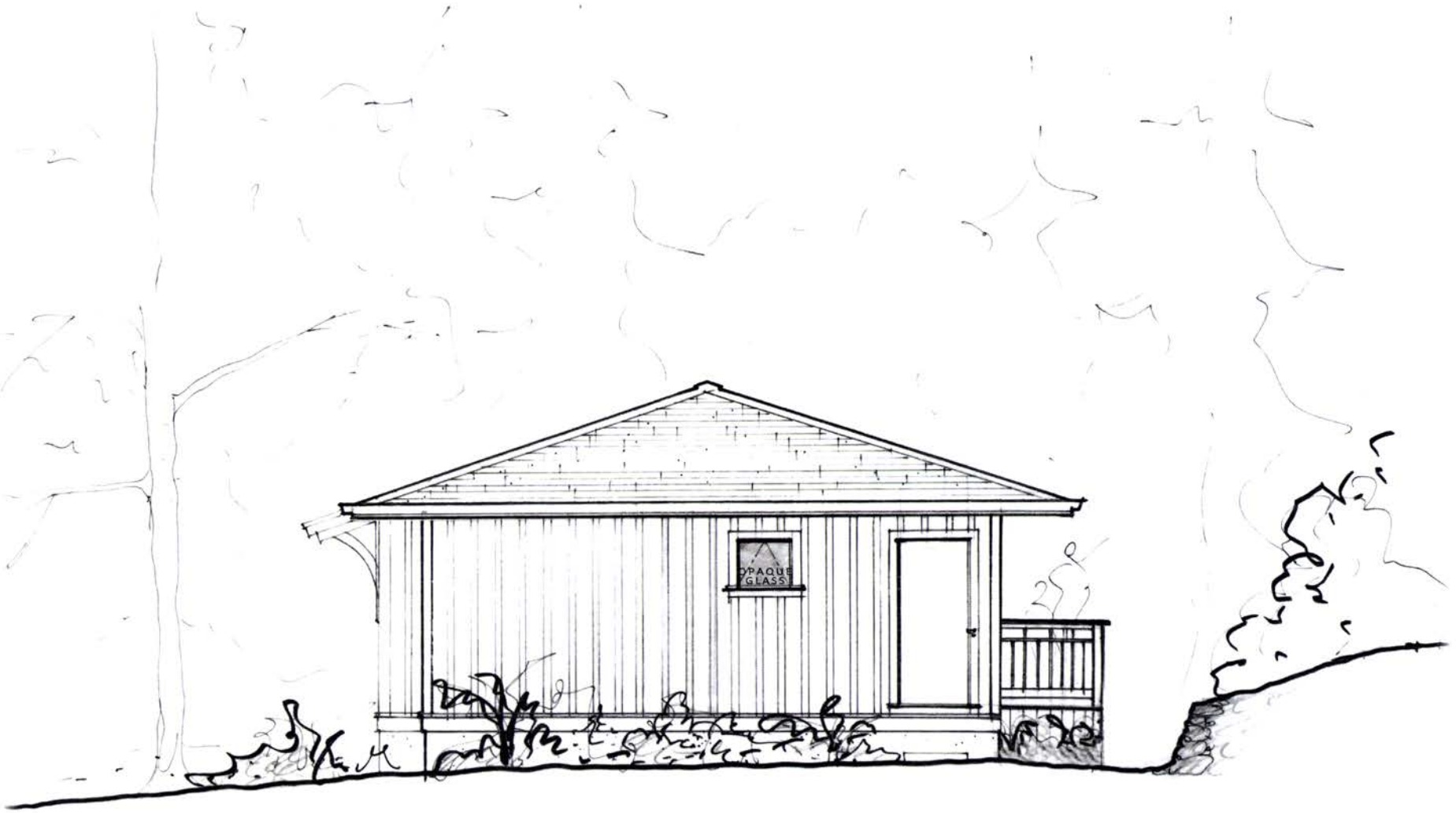

0 2 4 8

SOUTH ELEVATION

7.18.12

WINGET RESIDENCE
254 ROUND HOUSE CREEK ROAD
BIG LAGOON, CALIFORNIA

LACO ASSOCIATES
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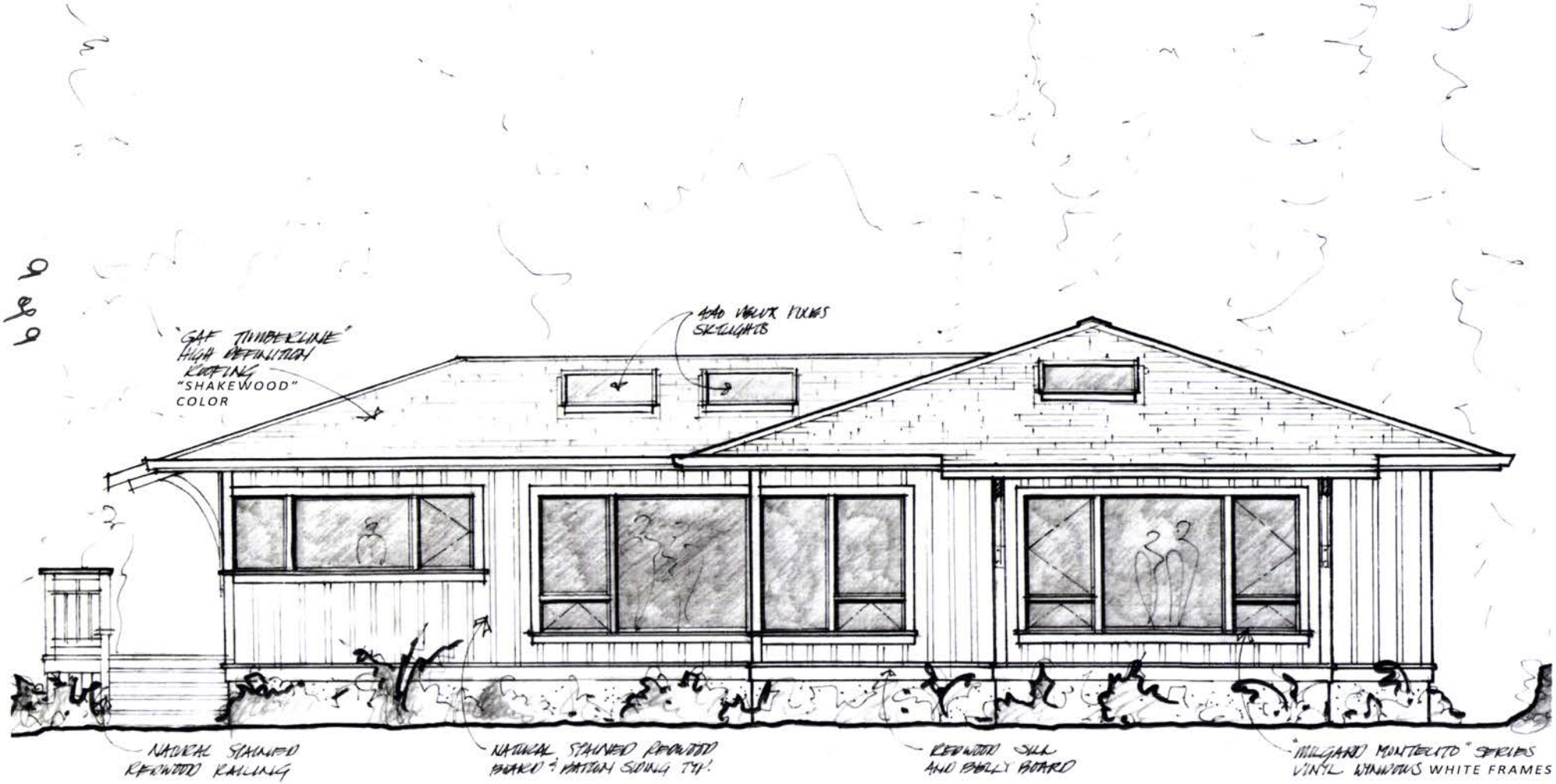
21 W. 4th St. · PO Box 1023 · Eureka, CA 95502 · 707.443.5054



WEST ELEVATION

7.18.12

WINGET RESIDENCE
254 ROUND HOUSE CREEK ROAD
BIG LAGOON, CALIFORNIA

LACO ASSOCIATES
ENGINEERS · GEOLOGISTS · ENVIRONMENTAL CONSULTANTS
21 W. 4th St. · PO Box 1023 · Eureka, CA 95502 · 707.443.5054

November 7, 2006

BUSCH GEOTECHNICAL CONSULTANTS

Mary Melvin
5220 Cummings Road
Eureka, California 95503

Recommended Setback for a Bluff-top Home Based on Erosion-Rate and Factor-of-Safety Considerations, 254 Roundhouse Creek Road, Big Lagoon Park Subdivision, Humboldt County, California [Lot 18, Melvin, APN 517-251-018]

EXECUTIVE SUMMARY

This report provides a setback for the Melvin home based on a methodology approved by the California Coastal Commission (CCC). The report characterizes the geologic site conditions, provides a preliminary quantitative evaluation (factor-of-safety analysis) of the stability of the bluff, and provides information about long-term and short-term erosion rates at the site. The report recommends a setback of 151 feet based on a conservative average long-term erosion rate of 1.0 ft/yr applied for 75 years and a 76-ft setback attributable to Factor-of-Safety calculations.

INTRODUCTION

Contract Information, Site Location, and Purpose of the Report

We are delivering this document under the terms of BGC contract #06-075. The ultimate purpose of this report is to provide a setback for the home based on a methodology approved by the California Coastal Commission (CCC). To

do this we characterize the geologic site conditions, provide a preliminary mathematical (factor-of-safety) analysis of the bluff, and provide information about long term and short term erosion rates at the site. **This report presents all of the geologic information necessary for the CCC to make a determination.**

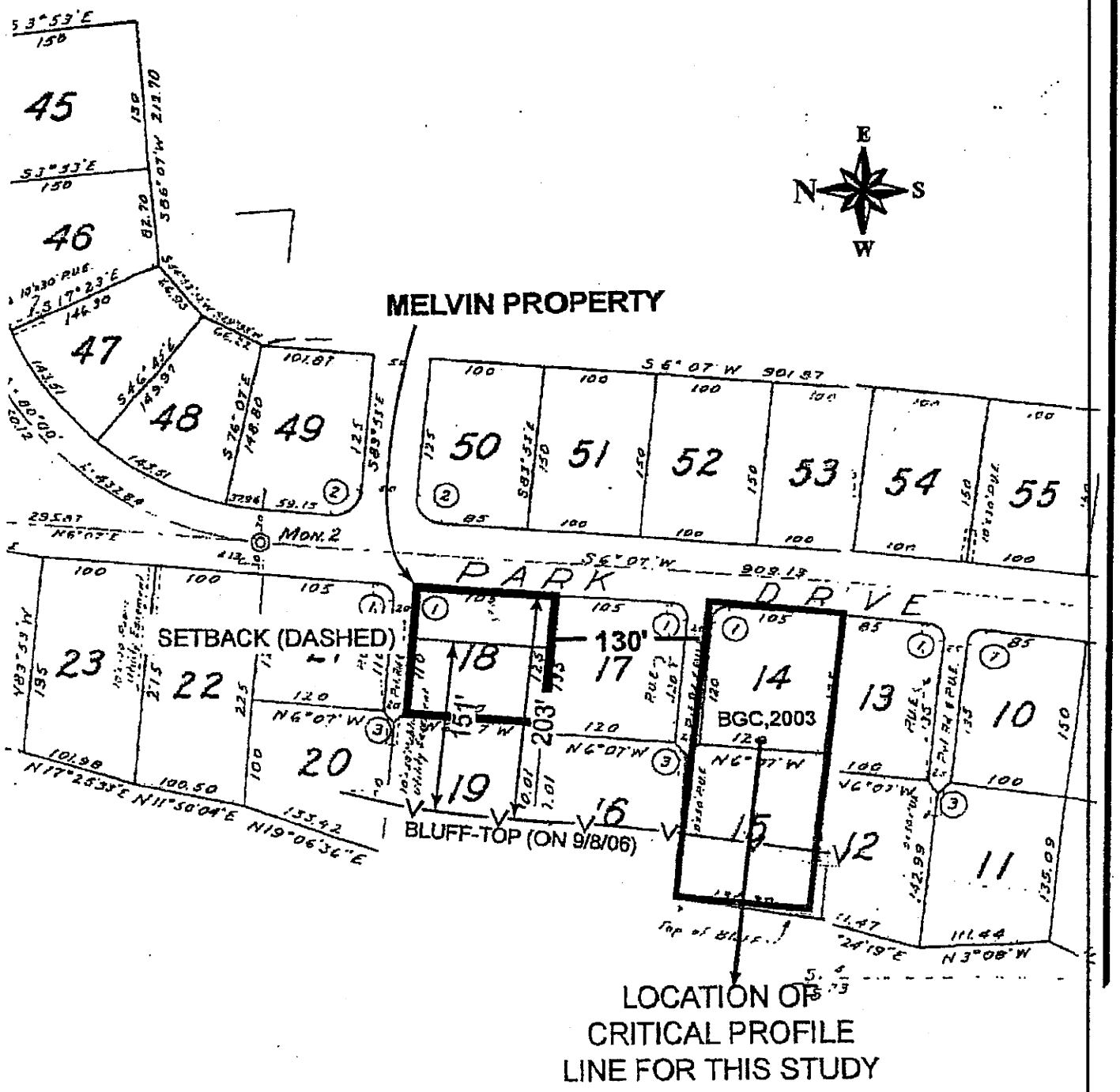
The subject property is located in the Big Lagoon Park Subdivision in northern Humboldt County. This area is about 6.5 miles north of Trinidad. The lot is in the southern part of the subdivision, west of Roundhouse Creek Road (see Figures 1 and 2). The lot is a bluff-top lot that overlooks Agate Beach.

Scope of Work and Methods

Generally speaking, and to simplify somewhat, our scope-of-work called for us to calculate historic short-term erosion rates and a long-term erosion rate of the Melvin property; to predict a future erosion rate; to complete a quantitative slope stability analysis based on measured and assumed site-specific conditions; to provide an overall risk assessment; and to recommend a minimum setback for a home constructed on the property based on our work. Specific tasks in our scope-of-work included:

- Reviewing pertinent professional literature, consultant's reports, maps, and stereographic pairs of air photos;
- Characterizing the stratigraphy of the site by describing the bluff face and selecting appropriate soil parameters for the various identified lithostratigraphic units;
- Characterizing the geology of the site;
- Completing a preliminary mathematical ("Factor-of-Safety") analysis of the bluff and identifying the location of the $FOS_s = 1.5$ line on the project base map;
- Providing erosion rate information and a recommended setback based on the long-term erosion rate and the preliminary FOS calculations;
- Providing a risk assessment for the proposed home relocation area; and
- Providing this report.

Figure 2. Portion of the Big Lagoon Park Subdivision Block A (W&K, 1962) showing the Melvin property (Lot 18), approximate location of the bluff-top on 9/8/06, location of FOS profile (BGC, 2003), and 151- foot building setback for the Melvin lot. Scale, ~1"= 133'.



On September 8, 2006, BGC Staff Engineering Geologist Beau Whitney and Staff Geologist Martha Woodward made a detailed inspection of the lot and bluff-face (as was possible without rappelling down the face). They took field notes and digital photographs and made a map to tape-and-compass accuracy standards.

We use standard practices and professional standards of care for all of our geotechnical studies. We also follow the recommendations provided by Southern California Earthquake Center (SCEC) for implementation of DMG Special Publication 117 (SCEC, 2002). For this job, we followed the bluff analysis methods described in Johnsson (2005). This report contains field data, the results of a preliminary factor-of-safety (FOS) analysis, a hazard and risk assessment, and recommendations.

ENGINEERING GEOLOGY OF THE SITE

Site Geology

The Big Lagoon Subdivision was built on an uplifted marine terrace, the 83,000-year-old Savage Creek terrace (Carver and Burke, 1992). The western, seaward edge of the terrace ends at the Pacific Ocean. Over time, the ocean has eroded into the terrace and created a bluff-backed shoreline. Along its entire length the bluff maintains a nominal >60° face with a near-vertical to slightly overhanging top. In map view the edge of the bluff is surprisingly linear, trending about N15°E. It does not contain deep cusps or "bites" caused by recent large bluff failures, and our review of aerial photographs dating back to 1942 indicates that it never has. We estimate that the deepest failure since 1942 bit back no more than ~40 ft into the top-of-bluff. The next two deepest failures removed no more than ~20 ft.

The site is located at the northern edge of the Mad River fault zone (MRfz) of Carver et al. (1982). The MRfz is the onland portion of the Cascadia fold and thrust belt (ibid.). Compressional tectonics in the belt formed the Big Lagoon fault (at the north side of Big Lagoon about 4.2 mi north of the Melvin site) and the Trinidad fault (which passes out to sea about 6 miles south of the site), and they tilted the Savage Creek terrace to the north (Carver, 1987). As a result of this northward dip, the bluff height varies from ~175 ft at Patrick's Point State Park about 5200 ft south of the site, to zero at the south edge of Big Lagoon where the terrace surface dives beneath the water. At the Melvin site, the top of the bluff is ~126 ft above the back-beach.

Along the western edge of the subdivision, erodible marine terrace sediments are exposed at the base of the sea cliff. Franciscan Complex bedrock, which is exposed in the headlands of Patrick's Park State Park and on the north side of Big Lagoon, across the Big Lagoon fault, does not outcrop at the base of the bluff in the subdivision. Here the beach is unprotected by offshore rocks or a nearby headland, so whenever winter storm waves strip the sand from the beach, the base of the bluffs—whether talus or in-situ soil units—begins to erode. At times the result is rapid-rate erosion of the bluff (e.g., Tuttle, 1981).

Based on their characteristics, we placed the marine sediments at the site into four main stratigraphic units (our soil units 2 through 5 of Figures 3 and 5). A dark brown eolian topsoil ~2 ft thick (not shown on Figure 5) caps the uppermost soil unit (unit 2). For our FOS analysis we grouped the beach sand and colluvium (soil debris) mantling the base of the bluff together as soil unit 1.

The uppermost soil unit (soil unit 2) is a loose, yellow-brown to olive-brown silty fine sand (USCS, SM) of probable eolian (wind-blown) origin. This unit is ~20 ft thick at the face of the bluff. Along most of the bluff face, this unit hold a near-vertical face.

Soil unit 3 is a coarse grained deposit (USCS, SW-GW). This unit is composed of alternating beds of pebble conglomerate, pebbly sandstone, and sandstone. Beds vary in thickness from a few inches to a few feet. The pebbles are well-graded subangular to well-rounded (mostly well-rounded) clasts derived from Franciscan Complex sites and reworked older marine terraces. The beds vary in thickness laterally and are a crudely fining upward sequence. Sub-horizontal bands of iron and manganese cementation of variable thickness are common throughout this unit.

Soil unit 4 is a medium dense, poorly graded, fine- to medium-sand ~45 ft thick (USCS, SP). The sand is slightly coarser than the sand in soil unit 3. The grains are subangular to subrounded. Low-angle cross-bedding is visible throughout the unit.

Soil unit 5 is covered with talus across most of the site. We described the unit from a small exposure south of the site. There, the unit is composed of alternating poorly graded sands with interlayer pebble conglomerate beds. This unit is composed of numerous fining-upward sequences.

Figure 3. Photograph of the Big Lagoon bluff face on 8/26/03 showing the five soil units used in the preliminary factor-of-safety analysis, and the profile line. Note the two geologist at the top of the bluff for scale. See Figure 2 for plan view of the Melvin property, profile line, and subject property for BGC, 2003.

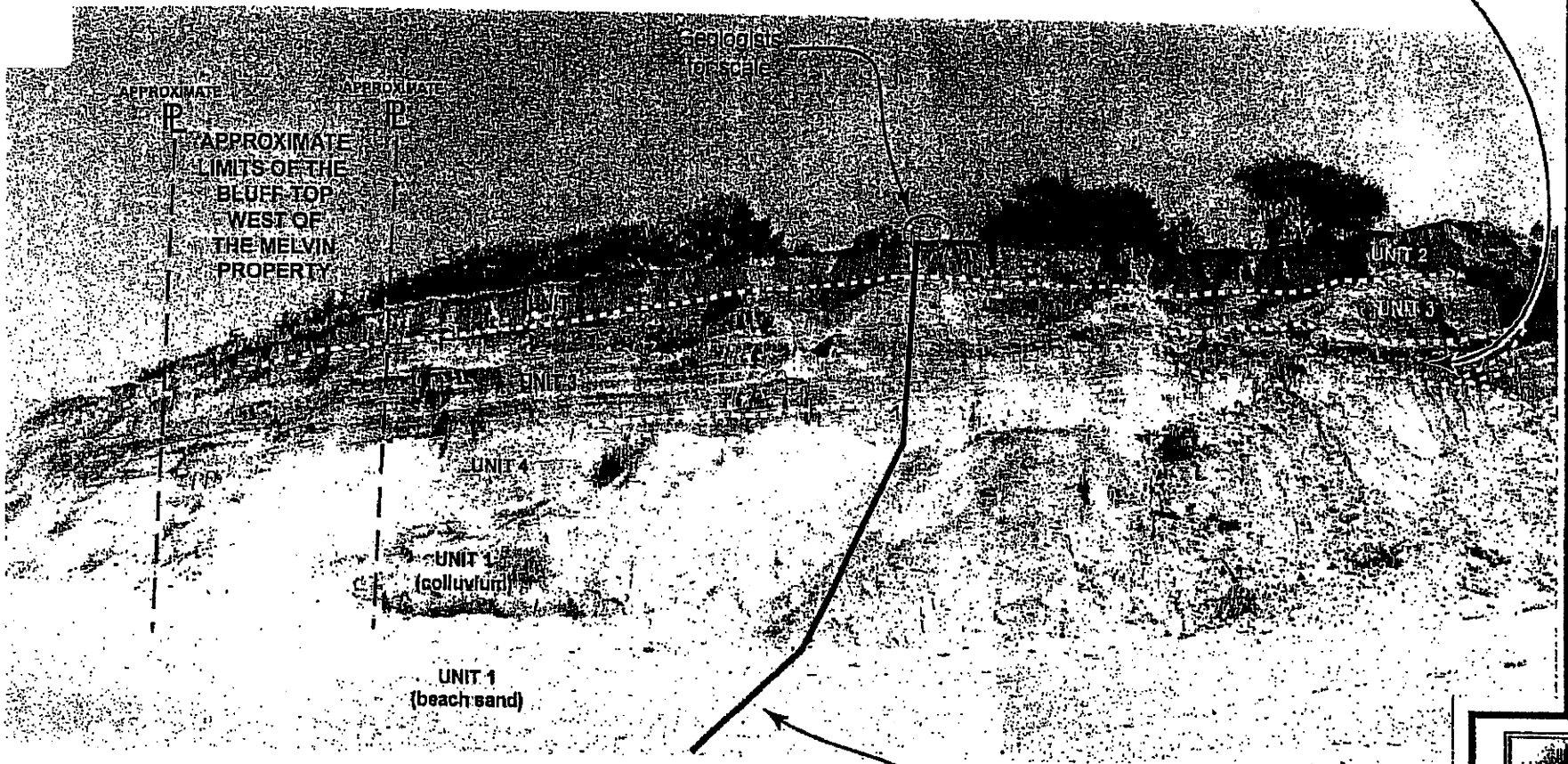
Soil Unit 1: Bluff colluvium and beach.

Soil Unit 2: Eolian sand (SM) with a topsoil cap (ML).

Soil Unit 3: Interbedded sand (SW) and gravel (GW) with iron and magnesium cementation.

Soil Unit 4: Cross-bedded sand (SP).

Soil Unit 5: Interbedded sand (SW) and gravel (GW) with repeating finning upward sequences (present off-view to the south, elsewhere hidden under Unit 1 colluvium).



NOTE: This figure contains color for clarity. If the figure does not contain color, then it has been reproduced.

Approximately 150 feet south of the property line within the upper part of soil unit 3 is a localized organic-rich deposit. Here, the conglomerate and sandstone beds of soil unit 3 change laterally into a dark brown to black clayey silt. The silt deposit is strongly lenticular and contains woody debris including seemingly in-place root masses. This deposit represents an isolated shallow-water, low-energy estuarine or lagoonal facies. This fine-grained layer impedes the downward percolation of groundwater, so springs, seeps, groundwater staining, and small soil pipes (open voids) are common in the bluff face just above these layers. Perhaps coincidentally—and perhaps not—this area is the approximate axis of the largest recent failure on the entire bluff face.

Aalto (1989) describes these soil units as part of the "upper Agate Beach deposit". Excluding the capping unit (soil unit 2), he interprets all of these deposits as records of storm events in a high-energy shallow-water environment. Near the Park stairway to Agate Beach, the upper Agate Beach unit is ~30 m thick. To the north the unit thickens to ~300 m (ibid.).

Seismic Hazard

Coastal northern California is located within an active tectonic regime. The most likely source of an earthquake that could affect this site is the southern part of the offshore Gorda plate. The predicted peak ground acceleration of the design-basis earthquake (DBE) for the area is 0.67 g (USGS, 2006).

The Big Lagoon area is located within the Mad River fault zone (MRfz), sandwiched between two active regionally significant thrust faults, the Big Lagoon fault about 4.2 miles north of the site and the Trinidad fault about 5.5 miles to the south. Both faults dip to the northeast. The slip plane of the Trinidad fault passes beneath the Melvin site at depth. The date of the last rupture of either of these faults is unknown, but the recurrence interval of individual faults within the MRfz varies from about 1500 to 5600 years (Petersen et al., 1996).

Work by geoscientists has demonstrated that great (M_w 8.0 to 9.0) earthquakes have occurred in the coastal Pacific Northwest in the recent past, and that the potential for similar earthquakes to occur is HIGH in the foreseeable future (within the next 200 years). These earthquakes occur along the northeast-dipping interface between the oceanic Gorda plate and the continental North America plate. Plate tectonic processes

are causing the offshore Gorda plate to subduct (dive down) beneath the North America plate, so it underlies North America beginning at the base of the continental slope, which is offshore. This tectonic interface, known as the Cascadia subduction zone or Csz, last ruptured on January 26, 1700 (Satake et al., 1996; Jacoby et al., 1997).

From 1995 until late 2004, the probability of a Csz event was cited as ranging from 5% (Adams, 1990) to ~10% to 20% within the next 50 years (Geomatrix, 1995; Charland and Priest, 1995). Those probabilities were based in part on the mean recurrence interval of Csz earthquakes as it was understood at the time. For example, assuming a unimodal (evenly spaced) distribution of events, Clark and Carver (1992) cited the recurrence interval as ~300 to 500+ years, and recent workers have cited it as 480-535 yrs (Kelsey et al., 2002), 570-590 yrs (Witter et al., 2003), and ~564 years (Goldfinger et al., 2003).

An even more recent analysis of the paleoseismic record concluded that Csz events might be bimodal, occurring in sets or clusters of earthquakes roughly 300 years apart, separated by a long (>700 yr) period. The recognition of this possibility resulted in the postulation of new, conditional probability estimates. **To simplify, if we are living in a period in which clustered events are to be expected, the conditional near-term probability for the next great Csz event could be as high as 45% within the next 50 years** (Mazzotti and Adams, 2004). **On the other hand, if the current interval is long, the conditional probability could be less than 1%** (ibid.). **Unfortunately, at present we do not know under which scenario we are living or if the bimodal distribution hypothesis is accurate.** To wit, an M 9.0 Csz event could occur today, tomorrow, or not for centuries.

A Csz event would cause a regional catastrophe in the Pacific Northwest. The Sumatra-Andaman Islands M 9.0+ earthquake of December 26, 2004, was caused by a megathrust of nearly 100 ft on just such a dipping subduction zone. Seismogenic failures of the bluff strand would occur during a Cascadia event.

Bluff Failure Processes, Global Warming, and Geodesy

In the Big Lagoon area, bluff failures are caused primarily by marine undercutting of the base of the erodible marine terrace sediments. As the base of the bluff erodes to an over-steepened slope angle (~70° to near-vertical), the sediments fail as

planar slides, debris slides, and "flake" failures of coherent blocks of sediment. Over time these failures cause the top-of-bluff to "backwaste" or "erode back."

In the Pacific Northwest in general, and in the Big Lagoon area in particular, undercutting by winter waves historically has caused dramatic, rapid, episodic shoreline retreat, especially during and following strong El Nino years. An El Nino is a climatic perturbation that effects the entire Pacific Ocean basin and the surrounding land masses. A strongly negative value of the June-November Southern Oscillation Index [SOI] is used to classify a year as a strong El Nino year (per the logic of Redmond and Koch, 1991). Typically, strong storms occur during an "El Nino winter." Based on the SOI, an El Nino winter occurred in 1940-41, 1941-42, 1946-47, 1951-52, 1965-66, 1972-73, 1977-78, 1982-83, 1987-88, 1993-94, 1994-1995, and 1997-98 (WRCC, 2003). Ranked by their SOI, the El Ninos of 1982-83 (-2.42), 1940 (-1.80), 1941 (-1.73), 1997 (-1.67), 1965 (-1.58), and 1977 (-1.52) were the strongest (ibid.). Of these, the Pacific Northwest was most affected by the 1982-83 event, which Quinn et al. (1987) classify as a very strong El Nino. Very strong El Ninos have an average recurrence interval of ~50 years, but a range of 13 to 150 years (ibid.). The previous very strong El Nino occurred in 1925-26 (ibid.).

Coastal erosion typically is greater (more rapid, more significant) during strong El Ninos because the winter water height is higher than average, large storms tend to be more frequent, and storm swells tend to be larger. In addition, wave trains may arrive from a different direction than usual. During an El Nino winter, after a few weeks of exceptionally adverse wave and current conditions, most of the sands and fine gravels on an affected beach have been moved offshore into deeper-than-usual water. When the protective beach is gone, marine undercutting of the base of the bluff begins, followed by rapid-rate bluff back-wasting. Furthermore, erosion remains more rapid afterwards, at least at sites where erodible bluffs have lost their beach, until the beach profile approaches its "normal" configuration. Unfortunately, the transport of the sand farther offshore prevents the sand from returning to the beach the following summer. As a result of the interaction of these complex factors, at least three of the five past strong El Ninos (1940-41, 1941-42, and 1997-98) have triggered an episode of rapid-rate bluff erosion in the Big Lagoon area (conclusion based on aerial photo research and review of reports including Tuttle, 1981; Falls, 1998; BGC, 1998; BGC, 2003; SHN, 1998; SHN, 2003a, b). Surprisingly, the 1982-83 "Very Strong El Nino" winter did <u>not</u> trigger a significant episode of erosion at the Melvin site.

When El Nino winter waves and the associated longshore currents redistribute beach sands, a multi-year episode of sea cliff erosion begins and does not abate until a beach is present again. This phenomenon was wide-spread in the Pacific Northwest following the 1982-83 El Nino (Komar, 1986; Tuttle, 1987; Peterson et al., 1990).

In addition, groundwater emerging from the bluff face can cause subsurface erosion and bluff instability. This process causes certain areas of the bluff top to experience larger-than-typical failures. Localized saturation, higher porewater pressures, and associated groundwater affects collectively may have been the cause of the recent failure south of the property (above the silt bed within soil unit 3).

Until recently, eustatic sea level rise has been cited as 1.8 +/- 0.2 mm/yr (Douglas, 1991). However, this rate may be accelerating. The "best midrange estimate" of the Intergovernmental Panel on Climate Change (IPCC, 2001) is that eustatic sea level will rise 50 cm over the next century, or 5.0 mm/yr. In Oregon, where the beaches have been studied in greater detail than in northern Humboldt County, many beaches have a 50:1 (H:V) slope (Peterson et al., 1991). Theoretically, and with other things held equal, a 2 mm rise of sea level each year could lead to a long-term retreat rate of an erodible bluff of ~10 cm/yr (3.9" or 0.33 ft/yr); a 5 mm rise could trigger a retreat of ~25 cm (9.9" or 0.8 ft/yr).

Despite the high potential for retreat, many Oregon bluffs show little or no retreat over a 50-year time span, probably because roughly equivalent tectonic uplift is occurring (Peterson et al., 1992). A similar situation exists for some Humboldt County and Del Norte County beaches. That is, tectonic uplift roughly offsets global sea level rise by raising the land at about the same rate as the sea.. The current estimate is that the Big Lagoon area is rising about 4 mm/yr (Mitchell et al., 1994). It is an ominous situation that sea level is rising, and that the rate of rise is increasing, because episodic bluff erosion presents the greatest hazard to the property.

Air Photo Review

For this project we reviewed the results of an aerial photo analysis we did three years ago for a bluff-top property 130 feet south of the Melvin site (BGC, 2003). Our observations, measurement rationale, and calculated bluff retreat rates from that study are applicable to the Melvin property, so we did not redo our air photo review. We include the following text from that report, edited for the Melvin property.

Summary of Air Photo Observations

(Excerpted and edited from BGC, 2003)

(All measurement distances are +/- ~11 ft; see following discussion)

To measure the position of the bluff top on the aerial photographs we used a Xerox machine capable of incremental (percent-by-percent) enlargements to enlarge each photograph about 400%. On the ground we measured the length of a specific feature that is present on all photographs (a field in a park), then we used that measurement to determine the exact scale of the enlargement. The field is less than 100 ft lower in elevation than the Melvin site, so the scales of the two areas are within 1% of each other (Avery, 1968). We worked in stereo with the original photographs to locate the exact position of the top edge of the bluff, then we measured the distance from the centerline of Roundhouse Creek Road to the edge-of-bluff on the enlargement. Using this methodology, we can measure the centerline-to-bluff distance to an accuracy of + / - about 11 feet. Although we can measure a distance to within 1/60th of an inch (equivalent to +/- ~5 to 6 ft at the enlarged scale of most of the photos), an additional error of up to ~5 ft is introduced by the historic variability of the position of the road centerline stripe. At present there are at least five centerline stripes on the road adjacent to the Melvin property. The difference between the two outside lines is about five feet. Additional discussion follows.

A large reentrant (for this coastal strand) was present ~260 ft south of the Melvin property from prior to 1942 through 1948. When it formed, the failure "bit" at least 50 ft out of the bluff top. (The failure might have occurred as one large failure, but more probably it happened as a series of small failures.) In the 1942, photos waves are lapping up against the base of the bluff. (Recall that successive strong El Ninos struck the Pacific Northwest and affected the Big Lagoon area during the winters of 1940-41 and 1941-42. The winter storms would have removed most—if not all—of the beach sand and triggered rapid-rate erosion.) By 1948, a narrow beach is present at the base of the bluff. (In the Big Lagoon area, even large storm waves cannot reach the base-of-bluff when a beach is present. The beach must be almost completed eroded away before marine undercutting of the base of the bluff can begin.)

In the 1954 and 1958 photos a wide beach is present at the base of the bluff, so the bluff was protected from wave erosion. Thick vegetation blankets the bluff face.

By 1962, the trees and brush on the terrace surface had been cleared and the infrastructure for this part of the subdivision had been started. The top of the bluff just

south of the Melvin site is bare and has a jagged appearance from recent small bluff failures. None of the failures appears to have removed more than 10 or 20 ft from the edge of the bluff.

By 1966, the access driveways for the lots in this part of the subdivision had been established. Bare soil is exposed across the entire bluff face, perhaps due to the 1965-66 El Nino winter. Despite the bluff failures, the edge-of-bluff is linear. Only one failure has removed a significant "bite" from the top of the bluff. This failure is located west of the intersection of Roundhouse Creek Road and Park Drive, but it does not appear to be a "typical" bluff failure. It is tear-drop shaped (the bulb end is in the bluff face), extends at least 100 ft into the bluff, and has a northwest-southeast trend (it is not perpendicular to the bluff face). A large alluvial fan is present on the beach at the outlet of the "tear drop." We suspect that this feature is the result of surface erosion of the bluff top and face caused by the heavy winter rains of December, 1964. We surmise that run-off captured by newly constructed Roundhouse Creek Road and part of the recently cleared terrace surface spilled over the edge of the bluff here and gullied it severely.

By 1970, homes had been constructed on the east side of Roundhouse Creek Road. Most of the bluff face was bare and a road had been built through the center of the tear-drop-shaped feature present in 1966. About 200 ft south of the Melvin property, a failure ~80 ft long had bit back into the bluff edge ~20 ft.

The 1974 and 1981 photos record a period of relative stability of the bluff top and face. On both photos, vegetation covers most of the bluff face. Home construction has continued in the subdivision on both sides of Roundhouse Creek Road.

In 1982, the upper part of the bluff face once again is mostly devoid of vegetation and has a jagged appearance. As in the 1962 and 1966 photos, the bluff face is linear and does not contain any significant reentrants.

Home construction continued in the subdivision through 1988. Several homes are visible on the west side of Roundhouse Creek Road. A small cuspate notch is barely visible ~200 ft south of the Melvin property. The cusp appears to have removed less than ~20 ft of the bluff edge.

The favorable scale of the 1996 photos permits a more accurate interpretation of detail. The cusp observed in the 1988 photos is still visible as a ~20-ft-deep "bite." The

south edge of the cusp merges into a narrow "peninsula" in the bluff top. The peninsula failed during the most recent (1997-98) episode of bluff failure.

To recap and summarize, the edge of the bluff south of Big Lagoon has remained essentially linear, trending ~N15°E, through the ~60 years of photos we reviewed. The largest bluff failure we observed "bit" into the bluff edge no more than ~40 ft (+/- ~11 ft), and failures <20 ft in depth (+/- ~11 ft) appear to be the characteristic failure size. (The larger-than-typical feature visible in the 1966 photos is a gully system related to surface runoff following road construction).

Erosion Rates

(Excerpted and edited from BGC, 2003)

In 1981, Don Tuttle of the Humboldt County Department of Public Works (now retired) compiled coastal bluff erosion data for much of the Humboldt County coastline (Tuttle, 1981). His data were based on historic photographs, aerial photographs, maps, survey notes, highway plans, historical letters and journals, archaeological reports, and interviews with long-time residents.

In the Big Lagoon area, Tuttle established numerous stations to measure bluff retreat on air photos taken between 1941 and 1974. He cross-checked his measurements using various other sources of data. In a nutshell, Tuttle found that the bluffs near Big Lagoon had retreated from 40 to 100 ft in the 50 years preceding his report (1981). Since then, retreat has continued in the same type of punctuated equilibrium that he recorded: decade-long periods of essentially no erosion have been broken by episodes of rapid erosion, the most recent occurring in response to the El Nino winter of 1997-98 (Tuttle, 2003, personal commun.).

Tuttle's data for 1941 to 1974 indicate that the bluff retreat rate near the Melvin property (stations 14 and 15) averages ~1.5 ft/yr. However, the next stations to the south (stations 16a and 16b) recorded a bluff retreat rate of 2.1 ft/yr and 2.7 ft/yr, respectively. The highest bluff retreat rate recorded was 4.6 ft/yr at station 18 (~1000 ft south of the Melvin property). Tuttle's work indicates that by 1974, erosion had removed about half of the depth of Lot 19 (the lot directly seaward of the Melvin property). Since 1974, seemingly only a few feet of erosion have occurred there (Tuttle, 2003, personal commun.).

For a previous project (BGC, 2003), we expanded on Tuttle's work by reviewing additional sets of aerial photographs. Our goals were to use the photos to attempt to quantify bluff retreat rates during specific time intervals per the methodology of Johnsson (2005) and to provide additional data for the time between 1974 and today. We gathered all stereo pairs of aerial photographs that were readily available from the Humboldt County Department of Natural Resources and the California Geological Survey Eureka office. The photos were taken in 1942, 1948, 1954, 1958, 1962, 1966, 1970, 1974, 1981, 1982, 1984, 1988, 1996, and 2000. We then measured the distance from the centerline of Roundhouse Creek Road, through the center of Lots 14 and 15 (nearby lots to the south of the Melvin property), to the top of the bluff. We also measured the length of an object visible on all photographs (a field bordered by roads). We used the length of the field to determine the actual scale of each photo. We did this for the photo at the original scale and as enlarged ~400% (see Table 1).

Standard textbooks (e.g., Avery, 1968) indicate that the mensuration of objects using aerial photographs is accurate only within limits. However, the degree of uncertainty can be quantified. To estimate our measuring error, we compared our measurement of the distance from the centerline of Roundhouse Creek Road to the top-of-bluff on the 1974 and 1981 photographs with the distance shown on a survey-controlled map of a nearby property to the south (Van Fleet, 1976). In each case, our measurement was <u>greater</u> than the distance as recorded on the map. We used the discrepancy (11 ft) to establish an error bar (+/- 11 ft.) around our measurements from the aerial photographs (Figure 4). Our accuracy was limited by several factors:

1) **Scale limitations and variations:** Before enlargement, the scale of the air photos ranges from 1"=2,500' (1:30,000) to 1"=614' (1:7,368). After enlargement, the scale ranges from 1"=700' (1:8,400 to 1"=150' (1:1,800). On the 1:30,000-scale photographs, trying to measure 5 ft of bluff retreat requires measuring to an accuracy of two thousandths of an inch. Our best ruler is accurate only to 1/60th of an inch. In addition, the field we used to scale the photos is about 100 ft lower in elevation than the study site. This change in elevation alters a 1:12,000 scale to 1:11,800 or 1:12,200, depending on which of these elevations the scaling targets were located (Avery, 1968).
2) **Variable position of the road centerline:** The location of the centerline of Roundhouse Creek Road has varied over time. Today, multiple painted centerlines are present on the road, and the location of the line varies by up to ~5 ft where observed.

3) **Reproduction distortion:** Even on an excellent Xerox machine, enlarging a photo might introduce distortion of 1 or 2% in at least one dimension. Because the field we used to scale the photos is not next to the study site, the two objects may have been distorted unequally.

The measurements made by Tuttle (1981) were subject to the same types of intrinsic inaccuracies. For example, Tuttle's measurement of the position of the bluff edge was accurate for some stations but has up to a ~19 ft discrepancy for others. We determined this by comparing his data to a survey-controlled map of a nearby site (Van Fleet, 1976).

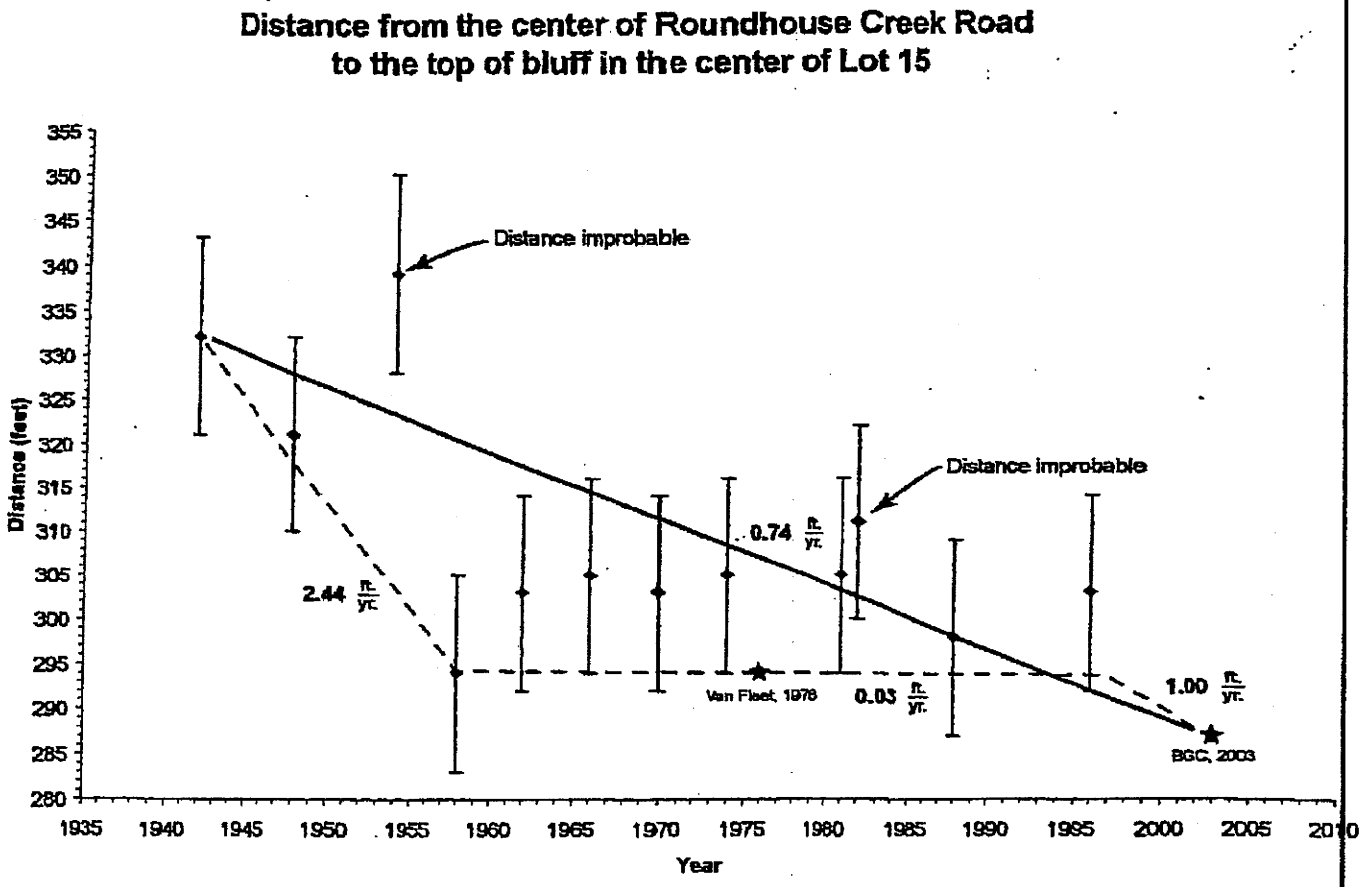
Applying a uniform error bar (+/- 11 ft.) to our data points (Figure 4), we drew "best fit lines" through the data field to estimate various possible "short term" erosion rates. We calculated the "long term" erosion rate for the site using the two end-member data points (1942, 2003). Our estimates of the "short-term" erosion rates are 2.44 ft/yr between ~1942 and ~1958; 0.03 ft/yr from ~1958 through ~1997; and ~1.00 ft/yr from ~1997 through the present (2006).

Although the calculated "long term" erosion rate (1942-2006) is 0.74 ft/yr, our recommended minimum setback distance is based on an erosion rate of 1.00 ft/yr (see **RECOMMENDATIONS**). Although 1.0 ft/yr is less than the rate Tuttle recorded for the general site vicinity based on the period 1941-1975, we believe it is appropriate to use because: it is conservative rather than liberal; it is based on 61 years of data (Tuttle's rate was based on ~34 years); and the bluff face currently is "unstable."

In summary, our work confirms that bluff erosion has been episodic and unpredictable in the strand of bluffs south of Big Lagoon. A significant episode of retreat began during the winter of 1940-41, and rapid-rate erosion apparently continued until about 1958. Then, the bluff remained relatively stable until late in the winter of 1997-1998, even though the coastline was subjected to numerous El Ninos, including the very strong El Nino of 1982-1983.

Although the intrinsic error associated with measuring the bluff position using air photos makes it nearly impossible to document small-scale (10-ft-deep) bluff failures with a high degree of confidence, the photos do allow a qualitative evaluation of the condition of the bluff. That is, we can see changes in vegetation on bluff face so can recognize periods of relative stability and instability of the bluff face and top.

Figure 4. Graph showing the distance from the center of Roundhouse Creek Road to the top edge of the bluff seaward of Lot 15. All distances were measured through the center of the Lots 14 and 15 (Critical Profile on Figure 2). See text for discussion.



Distance measured from aerial photographs.
The vertical lines are a nominal error bar associated with the measurement (+/- 11 ft).
Statistical analysis would be necessary for each flight year to determine the actual error.

★ Data point measured from a survey-controlled map.

0.74 ft/yr. Long-term erosion rate (1942-2003).

2.44 ft/yr. Short-term erosion rates (1942-1958; 1958-1997; 1997-2003).

Quantitative Slope Stability Assessment

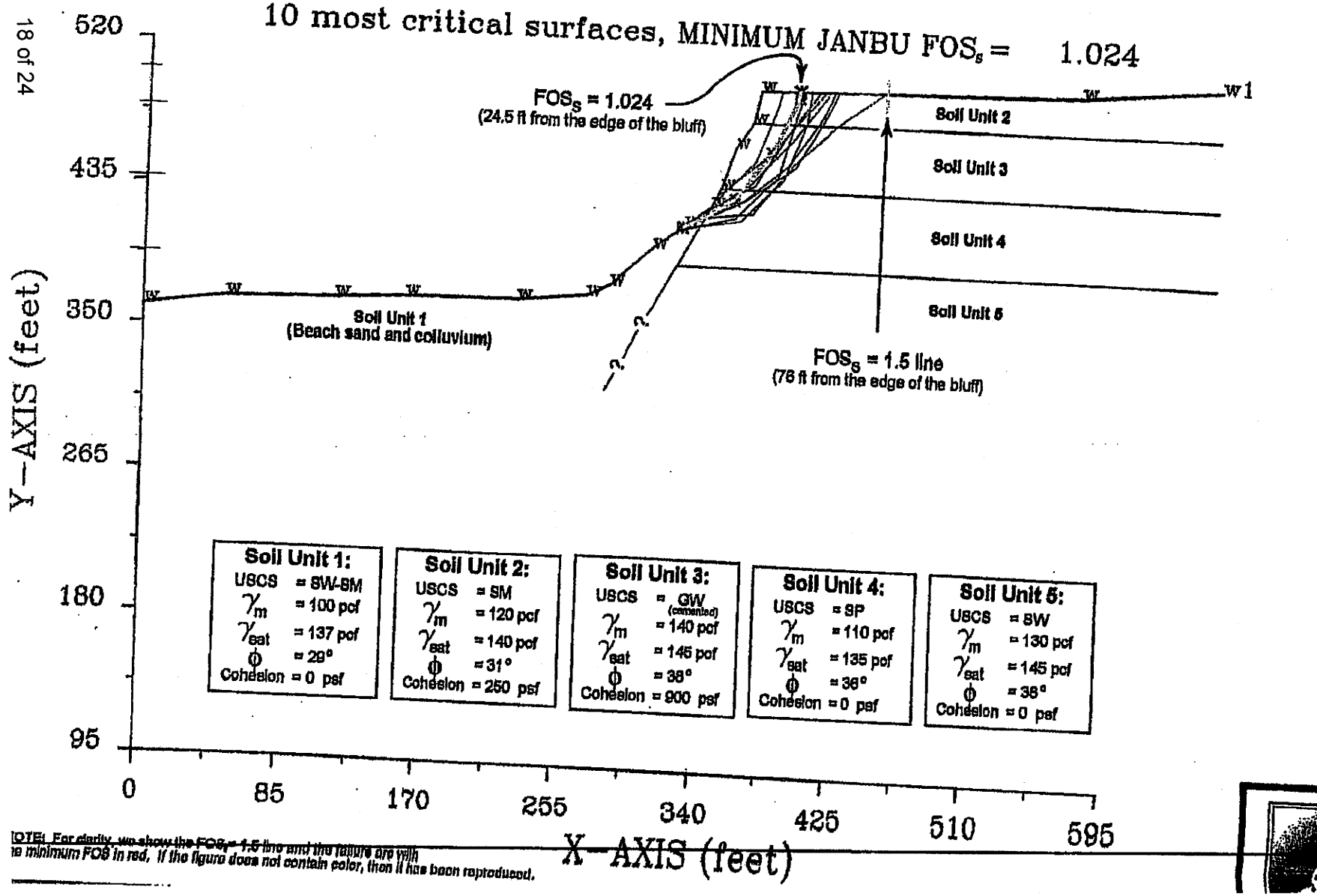
Description of Our FOS Model

The bluff on the Melvin property is ~126 ft high. The upper 19 ft is near-vertical. Below that, the slope of the face averages ~70°. A pile of talus estimated to be up to ~40 ft thick rests against the lower 55 ft of the face (see Figure 3 again).

To evaluate the level of risk the bluff might pose to a home constructed on the property above it, we completed a preliminary quantitative slope stability analysis of a critical slope profile (Figure 4). Our analysis is "preliminary" because a "final" analysis, if required, must be done by an engineer registered in California. The purpose of a preliminary analysis is to determine whether or not the stability conditions are so marginal that a final analysis is required. A preliminary analysis often uses assumed soil parameters whereas a final analysis often uses site-specific parameters derived from appropriately tested soil samples. Conditions are not marginal on the Melvin site, so a final analysis is unnecessary.

The mathematical analysis, which is called a "factor-of-safety" (FOS) analysis, assesses the stability of a slope by comparing the forces resisting failure to the forces driving failure. In a stable slope, the forces resisting failure exceed the driving forces, so the FOS is > 1.0. When the two forces are equal, the FOS = 1.0 and slope failure is imminent. The greater the FOS, the greater the stability of the slope. We used the modified Janbu method, the computer program XSTABL, version 4.0, and a 5-layer model. Based on our understanding of the site, we divided the bluff into five separate soil units and modeled the characteristics of each. To model extreme winter conditions, we saturated the soil profile to the surface, providing a "worst-case" scenario for the site. However, because the granular soils and free face facilitate drainage, it is improbable that the soils within many tens of feet of the face of the bluff could ever become saturated. Consequently, the FOS generated by our model is conservative (is lower than the true FOS, which would be determined by setting the groundwater table at the winter high level determined by over-winter groundwater monitoring).

Figure 5. Critical profile of the bluff. Profile located approximately 130 feet south of the Melvin property (see BGC, 2003 on Figure 2). All soil parameters assumed. Elevation datum arbitrarily set. See text for discussion.



NOTE: For clarity, we show the FOS$_s$ = 1.5 line and the failure are with the minimum FOS in red. If the figure does not contain color, then it has been reproduced.

The minimum allowable value for the static factor-of-safety (FOS_s) of a slope depends on the following (Duncan and Buchignani, 1975; SCEC, 2002):

(1) The degree of uncertainty in the shear strength measurements, slope geometry, and other conditions;

(2) The cost of flattening or lowering the slope to make it more stable;

(3) The cost and consequence of a slope failure; and

(4) Whether the slope is temporary (e.g., a construction cutbank) or permanent.

Typical practice is to recommend that the minimum static stability of an area of concern be $FOS_s = 1.2$ (Fang and Mikroudis, 1991) to 1.25 (Duncan and Buchignani, 1975), or greater (ibid.; Huang, 1983; SCEC, 2002; Johnsson, 2005). The better the soil stratigraphy and strength data are known, the lower the FOS_s can be because there is greater certainty in the "truthfulness" of the FOS analysis.

To model the Melvin bluff we used the same soil units and parameters we used to complete our evaluation of the site 130 ft to the south (BGC, 2003). CCC engineering geologist Johnsson accepted our results for that site (Johnsson, 2003), and the project proceeded to completion. There (and at the Melvin site), we identified the soil units exposed in the bluff face, then picked appropriate assumed soil parameters based in part on a nearby study (LACO, 2002), in part on our understanding of similar late Pleistocene marine terrace deposits we have studied elsewhere in Humboldt County (e.g., BGC, 1996a,b,c,d), and in part on published literature (Hunt, 1984, 2005). We ran reiterative analyses using different soil parameters until we were able to model a failure of about the same size ("bite back" depth) as the largest failure we observed on any aerial photograph.

In summary, our FOS work attempts to model the largest failures that occurred in the bluff during the past ~60 years. Our model is conservative because we set the groundwater table at the surface, a situation that cannot happen because of the steep bluff face and free-draining nature of the sediments.

Conclusions from Preliminary FOS Analysis

Figure 4 graphically present the results of our preliminary FOS analysis of the critical profile using the slope geometry, stratigraphy, and water table shown on the

figure. The soil parameters we used are listed on the figure. We do not show or discuss constraints (such as failure segment length) that we used. The figure illustrates the 10 most probable failure surfaces for the conditions evaluated; the failure surface with the asterisk is the surface with the lowest FOS. We did multiple other "runs" to model slightly different soil parameters and conditions. We selected this analysis as most representative of the site conditions as we understand them.

Our analysis suggests that the minimum static FOS for the critical profile is FOS_s = 1.02, and that the dynamic FOS for the same profile during the design basis earthquake (DBE) is FOS_d = 0.84. **The results of our preliminary FOS analysis indicate that the outermost ~24 ft of the edge of the bluff are Provisionally Stable. In plain English, the bluff edge is marginally stable. This is consistent with our air photo review of ~3200 linear ft of the Big Lagoon coastal strand bluff. None of the photos showed a failure that removed more than ~40 ft of bluff.**

Setback Philosophies

(Excerpted and edited from prior BGC reports)

To provide an oceanside setback distance for new construction or the relocation of an existing home, a consultant—at minimum—must specify a project lifespan (usually 75 years on the California coast), a known long-term average rate or a more conservative "predicted" rate (in feet or inches per year), and "an acceptable level of risk" (usually stated subjectively as LOW, MODERATE, or HIGH). The "acceptable level of risk" usually is specified as LOW, meaning that the probability of loss is low enough that "a prudent person of average economic means" would accept the risk (i.e., would buy or build the home) (see Appendix IV). Sometimes a MODERATE level of risk is acceptable, for example, when the owner is of above average economic means and can afford to repair or move a structure or other improvement. Even a HIGH level of risk might be acceptable to an owner, as long as the hazard is the destruction of personal property, not injury or loss of life. Thus building on or near a slow-moving landslide that could destroy the home might be acceptable, but building on or near a site that could suffer a nearly instantaneous, catastrophic failure never is.

In Oregon, a setback determined using the preceding approach usually is acceptable. However, on the California coast, a "minimum setback" generally is the sum of three components: (1) the erosion-rate component, (2) a component determined by calculating the location of the FOS_s = 1.5 line based on a critical profile, which is assumed to be a dynamic equilibrium profile (as discussed earlier), and (3) a component whose purpose is to further compensate for the uncertainties inherent in the analysis procedure.

Proposed Building Setback for a Home

Figure 2 shows the "minimum setback line" for a home constructed on the Melvin property. The line is 151 feet eastward of the present (November, 2006) top-of-bluff. The figure also shows the predicted location of the bluff in 75 years (in 2081), assuming an average erosion rate of 1.0 ft/yr. We used this slightly conservative rate (rather than the calculated 0.74 ft/yr rate) because there is uncertainty in the calculated rate, the bluff edge currently is Unstable, and the beach does not appear to have rebuilt to its "normal," pre-1996-97 winter width. Also, the additional 0.26/ft/yr provides a "buffer" against uncertainty. The "minimum setback line" is the sum of the setback component due to the predicted erosion and the component due to our FOS calculations. The figure also shows the location of the FOS_s=1.5 line (plotted as 76 ft behind the calculated position of the top-of-bluff 75 years in the future). The ground east of the FOS line (the "minimum setback line") represents the ground predicted to be "stable" 75 years in the future. This "stable" area includes approximately 52 ft of land west of Roundhouse Creek Road. The required roadside property line setback of 20 ft means that a swath of land 32 ft wide is available for construction of a home. If the westernmost portion of the home were cantilevered, and additional 10 ft (+/- ~ 2 ft) could be added to the footprint. However, doing this would be a "barbed sword" because the home would hang over land that otherwise would be available to allow house movers access for moving the home.

If the CCC accepts our assessment and conclusions, the owners may construct a home foundation 151 ft from the top-of-bluff as mapped in November, 2006 (see RECOMMENDATIONS). This distance theoretically provides for 75 years of erosion and a catastrophic bluff failure back to the FOS_s = 1.5 line.

RECOMMENDATIONS

RECOMMENDATION 1. Set the home foundation back a minimum of 151 feet from the edge of the bluff in November, 2006, which was 203 feet west of the western edge of pavement of Roundhouse Creek Road. It is permissible to cantilever the superstructure over this setback line, but be advised that doing so might shorten the useable lifespan of the home.

RECOMMENDATION 2. Use a home design and type of foundation that facilitate moving the home in the future.

RECOMMENDATION 3. To facilitate the design and construction of a home and to verify conformance with our setback distance, contact us to provide foundation soils bearing information

LIMITATIONS, CLOSURE, and AUTHENTICATION

Although we have used standard engineering geologic practices and professional standards of care to provide erosion-rate estimates, predictions, and a risk assessment, nothing in this report should be construed to state or imply a guarantee of safety of the home for any specific duration of time. Bluff retreat occurs in a largely unpredictable fashion, and it will continue to occur in the Big Lagoon area into the foreseeable future. Even if we have overstated the risk at the proposed site, and the future realized rate of bluff failure is less than the minimum rate we predict, it is important to understand that LOW risk is not the same as NO risk: rapid-rate bluff failure could occur before the calculated minimum economic lifespan is realized (herein stated as 75 years).

In conclusion, although the evaluation presented herein is based on a consideration of the geologic, geodetic, tectonic, and nearshore marine processes active at Big Lagoon, greater or lesser retreat rates than those documented in the past and predicted for the future may be realized in the next 75 years.

Thank you for hiring us. Please call if you have questions or we can help you in some other way. The following page contains our signatures and authentication stamp.

Busch Geotechnical Consultants

Signature on File

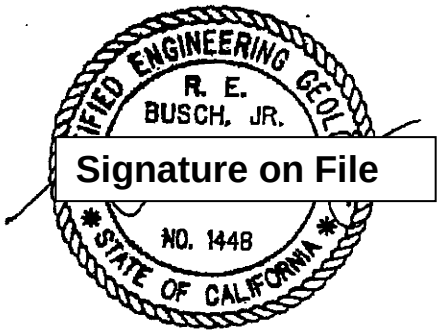
Beau Whitney
Project Geologist

Signature on File

Martha Woodward
Staff Geologist

Signature on File

R. E. Busch, Jr., Ph.D.
C.E.G. #1448



Signature on File

Attached: Appendices III and IV
Repository\GeotechClosed\Melvin\Melvin,SS.FOS.doc OVW:03048

REFERENCES CITED

Aerial Photographs

(1942-1988 photographs at Humboldt County Department of Public Works, Division of Natural Resources; some of these and later years are at California Geological Survey, Eureka)

1942. USDA, black and white, flight CVL 9B-113 and -114, nominal scale 1:12,000, dated February 16, 1954.

1948. CDF, black and white, frames 2-16-50 and CDF 2-16-51, nominal scale, 1:20,000, dated June 23, 1948.

1954. USDA, black and white, flight CVL, frames 13N-106 and -107, nominal scale 1:20,000, dated August 3, 1954.

1958. CVL, black and white, flight HU, frames 10-55 and 10-56, nominal scale 1:20,000, August.

1962. Humboldt County Assessor, black and white, flight HCN-2, frames 12-61 and 12-62, nominal scale ~1:12,000, dated August 22, 1962.

1966. Humboldt County Assessor, black and white, flight HC-66, frames 15B-70 and 15B-71, nominal scale ~1:12,000, June.

1970. Unknown (probably Humboldt County Assessor), black and white, flight CH-70, frames 15B-77 and 15B-78, nominal scale ~1:12,000, dated July 21, 1970.

1974. Humboldt County Assessor, black and white, flight HC-74, frames 15B-9 and 15B-10, nominal scale ~1:12,000, September.

1881. CDF, black and white, flight CDF-ALL-CR, frames 2-6 and 2-7, nominal scale 1:24,000, dated June 15, 1981.

1982. Unknown, color, nominal scale 1:7,200, dated January 5, 1982 (?).

1988. WAC Inc., black and white, flight WAC-88CA, flight 2-35, -36, nominal scale ~1:31,680, dated March 3, 1988.

1996. WAC , black and white, flight 96CA, flight 30-280 and 30-281, nominal scale 1:12,000, dated September 7, 1996.

2000. WAC Inc., black and white, flight WAC-00-CA, frame 7-132, dated March 31, 2000.

Professional Literature, Consultant's Reports, and Maps

Aalto, K. A. 1989. Geology of Patrick's Point State Park: California Geology, v 42. pp. 125-133.

Avery, T. E. 1968. Interpretation of aerial photographs. Second Edition. Burgess Publishing Co., Minneapolis. 324 pp.

BGC [Busch Geotechnical Consultants]. 2003. Recommended setback for the Rohner Bluff-top home based on an erosion-rate analysis and factor-of-safety considerations, 294 Roundhouse Creek Road, Big Lagoon Park subdivision, Humboldt County, California [APNs 517-251-14 and 517-251-15]. Unpubl. rept. for client dated October 6, 2003, on file with the California Coastal Commission, Eureka. 32 pp. text + 7 pp. appends.

BGC [Busch Geotechnical Consultants]. 1998. Cause of failure of the Rita Lakin bluff-top residence above Agate Beach, 242 Round House Creek Road, Big Lagoon, Humboldt County, California [Allied Insurance Claim # 84D90270]. Unpubl. rept. for client dated 26 September. 7 pp. + 2 pp. photos.

BGC [Busch Geotechnical Consultants]. 1996a. Final report: Results of geotechnical investigation of the Industrial Arts slope failure, Eureka High School Campus, Eureka, California. Unpubl. rept. for client [Eureka City Schools] dated 24 September. 16 pp. + 43 appends. + over-sized figs.

BGC [Busch Geotechnical Consultants]. 1996b. Engineering geology of a landslide head, with supporting geotechnical design parameters for a proposed Hilfiker welded wire wall, Younger property, 2158 Woodcrest Court, Eureka, CA. Unpubl. rept. for client [Younger] dated 30 August. 8 pp. + 18 pp. appends. + over-sized map.

BGC [Busch Geotechnical Consultants]. 1996c. Geotechnical investigation of 1 January 1997 landslide, contiguous hillslopes, and affected Phase II lots, Danco Builders' Foxwood Estates Subdivision, Arbutus Street, Eureka, California. Unpubl. rept. for client [W. B. Sweet, Civil Engineer]. 61 pp., incl. appends. + over-sized map.

BGC [Busch Geotechnical Consultants]. 1996d. Geotechnical conditions at the Foxwood Drive drainage head crossing, Danco Builders Foxwood Estates Subdivision, Cutten, California. Unpubl. rept. for client [Neale B. Penfold, Penfold Engineering]. 25 pp. + appends.

Carver, G. A., 1987. Late Cenozoic Tectonics of the Eel River Basin Region, Coastal Northern California. in Tectonics, Sedimentation, and Evolution of the Eel River and Other Coastal Basins of Northern California, Schymicek, H. and Suchland, R., Eds. San Joaquin Geol. Soc. Misc. Publ. 37, San Joaquin Geological Society, Bakersfield, CA. pp. 61-72.

Carver, G. A. and Burke, R. M. 1992. Late Cenozoic deformation on the Cascadia subduction zone in the region of the Mendocino triple junction, pp. 31-63. IN, Friends of the Pleistocene Guidebook for the Field Trip to Northern California.

Charland, J. W. and G. R. Priest. 1995. Inventory of critical and essential facilities vulnerable to earthquake or tsunami hazards on the Oregon coast. Oregon Dept. of Geology and Mineral Industries. GMS-100, 1 sht.

LACO

November 19, 2012

7473.00

California Coastal Commission
710 E Street, Suite 200
Eureka, California 95501

Attention: Melissa Kraemer

Subject: Request for Information
Coastal Development Permit Application 1-12-023
Assessor's Parcel Number 517-251-018

EXHIBIT NO. 8
APPLICATION NO.
1-12-023 – WINGET
LACO ASSOCIATES GEOLOGIC REPORTS (EXCERPTS) (1 of 24)

Dear Ms. Kraemer,

On behalf of Dale and Lei Winget, LACO submits this letter in response to your October 17, 2012, correspondence regarding the above referenced coastal development permit application.

The above referenced correspondence made a request for information which we present below:

> *The geotechnical analysis should consider the effects of future climate change and sea level rise in the analysis of the rate of bluff retreat over the proposed development's economic lifespan. Please provide an addendum to the geotechnical report that addresses this information.*

Response

Appendix B of the December 16, 2011, *Geotechnical Report* prepared by LACO contains a 2006 report by Busch Geotechnical Consultants (BGC, 2006) that provides a recommended bluff-top setback. The recommended setback was determined in accordance with the current published methodology by the California Coastal Commission for establishing development setbacks from coastal bluffs (Johnsson, 2003).

A discussion of climate change/sea level rise and the effect on the estimated erosion rates at the subject site is presented in the 2006 report prepared by Busch (pp. 9-11).

Following the methodology adopted by the California Coastal Commission as presented in the 2003 paper by Johnsson (pg. 16), a buffer is not necessary to account for potential future increases to the long term bluff retreat rate associated with climate change/sea level rise because the recommended slope stability component of the setback for this site exceeds 10 feet.

We trust the provided information addresses your request. Please call me at (707) 443-5054 if you require additional information or need clarification.

Sincerely,
LACO Associates

Signature on File

Bryan Dussell, CEG
Senior Engineering Geologist

BED:gg

References

Busch Geotechnical Consultants, 2006, Recommended Setback for a Bluff-top Home Based on Erosion-Rate and Factor-of-Safety Considerations, 254 Roundhouse Creek Road, Big Lagoon Park Subdivision, Humboldt County, California [Lot 18, Melvin, APN 517-251-018]. Unpublished client report, 27 p.

Johnsson, M. J., 2003, Establishing Development Setbacks From Coastal Bluffs, Proceedings, California and the World Ocean'02. Orville Magoon (ed.), 21 p.

cc: Dale and Lei Winget

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GEOTECHNICAL REPORT

New Single-Family Residence
254 Roundhouse Creek Road
Big Lagoon, California

Assessor's Parcel Number 517-251-018

Prepared for:
Dale Winget
311 West Harris Street
Eureka, California 95501

Prepared by:
LACO Associates
21 W. 4th Street
Eureka, California 95501

Signature on File

Giovanni A. Vadurro, CEG 2554, Exp. 5/30/13

LACO ASSOCIATES
ENGINEERS · GEOLOGISTS · ENVIRONMENTAL CONSULTANTS
21 W. 4th St. · PO 1023 · Eureka, CA 95502 · 707.443.5054

December 16, 2011
LACO Project No. 7473.00

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GEOTECHNICAL REPORT

New Single-Family Residence
254 Roundhouse Creek Road, Big Lagoon, California
Assessor's Parcel Number 517-251-018
LACO Project Number 7473.00

1.0 INTRODUCTION

1.1 Purpose

LACO Associates (LACO) performed a Geotechnical Investigation in support of the design and construction of a new single-family residence in the Big Lagoon Subdivision, in Big Lagoon, California. The project site is located along the west side of Roundhouse Creek Road, west of US Highway 101 (Figure 1).

The investigation described in this Report was performed in accordance with the Scope of Work outlined in our Engineering Services Agreement dated July 22, 2011, and approved by Mr. Dale Winget (Client) on July 26, 2011. The primary purpose of this investigation was to explore and characterize subsurface soil conditions at the site, to develop geotechnical recommendations and design criteria for permitting purposes, foundation support, and earthwork construction for the new building.

The Scope of Services for this investigation included characterizing the subsurface soil conditions, assessing potential geologic hazards to the new development, providing recommended foundation design criteria to be utilized for design and construction of the new development, and preparing this Report in accordance with Section 1802, Chapter 18 - *Foundation and Soils Investigations*, of the 2010 California Building Code (CBC), to meet the permit requirements of the County of Humboldt Division of Planning and Building. The following information, recommendations, and design criteria are presented in this Report:

- Description of site terrain and local geology;
- Description of subsurface soil and groundwater conditions interpreted from field exploration;
- Assessment of potential earthquake-related geologic and geotechnical hazards, including surface fault rupture, strong seismic ground shaking, and slope instability;
- Seismic design parameters per the applicable portions of the 2010 CBC, including site classification, seismic design category, and spectral response accelerations;
- Discussion of appropriate foundation design options;
- Recommendations regarding foundation elements, including:
    - Allowable bearing pressures or capacities (dead, live, and seismic loads)
    - Estimates of settlement (total and differential); and
    - Minimum foundation embedment; and
- Recommendations for earthwork, site and subgrade preparation fill placement, and compaction standards.

1.2 Limitations

This Report has been prepared for the exclusive use of our Client, his contractors and subconsultants, and appropriate public authorities for specific application to development of the site. LACO has endeavored to comply with generally accepted geotechnical engineering standard of care common to the local area. LACO makes no other warranty, express, or implied.

The analyses and recommendations contained in this Report are based on data obtained from subsurface explorations. The methods used indicate subsurface conditions only at specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Samples can not always be relied on to accurately reflect stratigraphic variations that commonly exist between sampling locations, nor do they necessarily represent conditions at any other time. Results of any analysis of samples obtained during this project will be retained on file in our office. Unless directed otherwise by our Client, collected samples will be discarded after 30 days following the issuance of this Report.

The recommendations included in this Report are based, in part, on assumptions about subsurface conditions that may only be tested during earthwork. Accordingly, the validity of these recommendations is contingent upon LACO being retained to provide a complete professional service. LACO cannot assume responsibility or liability for the adequacy of the recommendations when they are applied in the field unless LACO is retained to observe construction. We will discuss the extent of such observations required to provide assurance of the validity of our recommendations upon request.

Do not apply any of this Report's conclusions or recommendations if the nature, design, or location of the facility is changed. If changes are contemplated, LACO should be consulted to review their impact on the applicability of the recommendations in this Report. Also note that LACO is not responsible for any claims, damages, or liability associated with any other party's interpretation of the subsurface data or reuse of this Report for other projects or at other locations without our express written authorization.

2.0 PROJECT DESCRIPTION

2.1 Project Location

Pertinent project site location information is listed in Table 1 below.

Table 1 – Project Location Information

Latitude and Longitude	41.1538°N and -124.1357°W
Legal Description	NW ¼ of Section 24 Township 9N Range 1W HB&M
Parcel Size	0.3 acres
USGS Quadrangle	Trinidad 7.5-minute topographic quadrangle

2.2 Proposed Development

The project site is currently undeveloped and encompasses nearly level to gently sloping ground with a northerly slope aspect. The project site owners propose to construct a new single-family residence. The area proposed for development is located near the easterly property boundary adjacent to Roundhouse Creek Road (Figure 2). The new structure will be of typical wood-frame construction and founded on a continuous concrete perimeter foundation. Ingress and egress is from an existing gravel driveway accessed from the northeast corner of the parcel off of Roundhouse Creek Road.

The residence will be served by local utilities. Water will be supplied by the Big Lagoon Water District. Additional site improvements include an onsite sewage disposal system, gravel parking area, and vegetation removal.

All above ground and below ground developments will be set back a minimum distance of 151 feet from the top edge of the coastal bluff. The development setback is based on the recommendations presented by Busch Geotechnical Consultants (Busch) in a report dated November 7, 2006, prepared for the previous land owners under similar site conditions. The setback distance was determined by methodology previously approved by the California Coastal Commission for a parcel located 130 feet to the south of the current project site (California Coastal Commission, 2003). LACO has not conducted an independent assessment and has relied upon the Busch recommendations without additional verification.

3.0 FIELD EXPLORATION

Three soil test pits were excavated with a mini-excavator to assess the *in-situ* soil conditions and determine the engineering characteristics of the subsurface materials underlying the project site. The test pits were excavated to a maximum depth of 10 feet below ground surface (bgs) and were located to provide a cross-sectional view of the subsurface within the new building footprint. Test pit exposures were logged in the field by a Certified Engineering Geologist from our office in general accordance with ASTM D2488 (Visual-Manual Procedure). Upon their completion, the test pits were backfilled with spoils to existing grade. All test pits were located outside of the proposed building footprint location to mitigate the potential for future settlement beneath the foundation. Test pit locations with respect to the building footprint are depicted on the Figure 2 Site Plan. Soil Profile Logs containing the soil classifications are included as Appendix A.

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 Site Conditions

The project site is located on an uplifted Pleistocene marine terrace surface that slopes gently to the north at an average gradient of less than four percent. Topographically, the portion of terrace surface within the project site boundaries is situated between the 120-foot and 160-foot topographic contours as depicted on the Trinidad Quadrangle, 7.5-minute series.

4.2 Geologic Setting

The field investigation indicates the project area to be underlain by uplifted and north tilted late Pleistocene marine terrace deposits. Previous geotechnical drilling investigations conducted by LACO in the Big Lagoon and Patrick's Point State Park areas indicate the Pleistocene marine terrace deposits to consist of alternating sequences of medium dense to very dense, poorly graded gravels with sands and clays, and poorly graded sands with gravel and silt. Overlying the marine terrace deposits are beach and eolian deposits consisting of dune sand and a silt cap likely to have been deposited following uplift and emergence of the marine terrace sediments.

The beach profile from Agate Beach to Big Lagoon is characterized by a steep beach face and relatively shallow sloping berm that comprises the backshore environment. The steeply sloping beach face is a reflection of the coarse particle size being transported and deposited within the swash zone and along the beach face. A longshore bar does not appear to be present as a result of the coarse particle size. The entire beach system can be morphologically classified as a "reflective" beach due to its steep, linear beach faces, and well-developed beach cusps and berm. As is typical of reflective beaches, the entire beach system from Agate Beach to Big Lagoon experience surging breakers and high run-up. The lack of a longshore bar allows wave energy to be delivered directly to the beach face unimpeded, resulting in an erosive coastline that has experienced significant coastal retreat.

4.3 Seismicity

This project site is located within a seismically active region in which large earthquakes are expected to occur during the economic life span (75 years) of the development. North of the Mendocino triple junction, the regional tectonic framework is controlled by the Cascadia Subduction Zone (CSZ), wherein oceanic crust of the Juan de Fuca/Gorda plate is being actively subducted beneath the leading edge of the North American plate. The CSZ in its entirety extends from the Mendocino triple junction to British Columbia. Plate convergence along the Gorda segment of the CSZ is occurring at a rate of approximately 30 to 40 millimeters per year (mm/yr) (Heaton & Kanamori, 1984). Rupture along the entire CSZ boundary may produce an earthquake with a maximum moment magnitude (M_w) of 9.0 or greater (Satake, 2003).

Upper plate crustal deformation associated with the subduction of the Gorda plate is expressed as a 90-kilometer (km) wide fold and thrust belt that comprises the accretionary complex along the North American plate margin (Carver, 1987). Faults associated with the offshore and onshore portions of the CSZ fold and thrust belt, include the Little Salmon and Mad River fault zones.

The project area is located in the northerly portion of the Mad River fault zone along the northeast-dipping backlimb of the Trinidad anticline as evidenced by the tilted nature of the underlying terrace deposits. The Trinidad fault is an active reverse (thrust) fault located less than seven miles south of the project site, and is recognized to be the fault responsible for the active growth of the Trinidad anticline. The offshore trace of the Trinidad fault may be as close as four miles to the project site.

The Trinidad fault is recognized by the State of California as being active with an assigned slip rate of 2.5 ± 1.5 mm/yr (USGS, 1996). The Trinidad fault consists of a northwest striking, northeast dipping thrust fault with a reported dip of 45 degrees. The upper-bound earthquake considered likely to occur on the Trinidad fault has an estimated M_w of 7.3 (ICBO-CDMG, 1998).

Based on the record of historical earthquakes (approximately 150 years), faults within the plate boundary zone and internally deforming Gorda Plate have produced numerous small-magnitude and several moderate to large (i.e., magnitude greater than 6) earthquakes affecting the local area. Several active regional seismic sources in addition to those described above are proximal to the project site and have the potential to produce strong ground motions. These seismic sources include:

- The northern segment of the San Andreas transform fault that represents the boundary between the stable North American plate and the northwest-migrating Pacific plate;
- The Mendocino fault, an offshore, high-angle, east-west-trending, right-lateral strike-slip fault that forms the boundary between the Gorda and Pacific plates; and
- Faults within the internally-deforming Gorda plate consisting of high-angle, northeast-trending, left-lateral, strike-slip faults.

4.4 Soil Conditions

Detailed descriptions of the subsurface stratigraphy encountered during our field investigation are provided in the Soil Profile Logs included as Appendix A.

The generalized stratigraphy underlying the project site within the upper 10 feet of the soil profile consists of eolian (wind blown) silt and fine sand overlying beach and marine terrace deposits composed predominantly of medium dense silty sand (SM) grading downward to medium dense poorly graded sand with silt (SP/SM) to the maximum depth explored. The underlying deposits are interpreted to be laterally continuous across the building footprint given the general uniformity of the depositional sequence as observed in the test pits.

4.5 Groundwater Conditions

No groundwater was encountered in the location of our test pits to depths of 10 feet bgs. Transient groundwater conditions are not anticipated to have an adverse affect on foundation performance or be present during foundation construction.

5.0 GEOLOGIC HAZARDS

Potential geologic and geotechnical hazards present at the site primarily include surface fault rupture and strong seismic ground shaking. The assessment for these potential hazards to occur, and those geologic hazards with a lower likelihood of occurring, is presented below.

5.1 Surface Fault Rupture

As depicted on the Official Map of the State of California Special Studies Zones (CDMG, 1983; CDMG, 2000), an onland segment of the Trinidad fault is located approximately seven miles to the south of the project site (Figure 3). Therefore, the potential for fault surface rupture to adversely affect the new structure is considered low.

5.2 Liquefaction

Liquefaction is a soil behavior phenomenon in which soil strength is rapidly decreased due to high excess pore-water pressure generated by strong earthquake ground motions. Geologically young and relatively unconsolidated granular soils and artificial fills located below the groundwater surface are susceptible to liquefaction (Youd and Perkins, 1978). Relatively clean, loose, uniformly graded sand and non-plastic silts are typically most susceptible to liquefaction.

Based on the age and density of the subsoils exposed in the test pits and nearby coastal bluff exposures projected to underlie the site, the hazard due to potential soil liquefaction is considered low. Additionally, as presented on Map S-3 of Special Publication 115 (CDMG, 1995), the project site is not located in an area with a liquefaction potential.

5.3 Settlement

Settlement is a function of the foundation loading and the bearing soils. No anticipated foundation loads have been provided at the time this Report was prepared. There is up to 2 feet of soft, compressible soil consisting of soft, organic-rich silt (i.e. native topsoil), underlying the site. Typical "code foundations" may experience excessive settlement under some loading conditions. The foundation bearing subsoils below 2 feet of the existing ground surface consist of medium dense, consolidated soils that are relatively uniform across the site. Provided the subgrade is adequately prepared, and load bearing structural elements are founded on these uniform materials below 2 feet of the existing ground surface, the risk of differential and total settlement is low and is not anticipated to adversely affect the structure.

5.4 Landsliding

Events of the recent past indicate the coastal bluffs along this stretch of coast to be highly susceptible to slope failure. Slope failure along the entire coastal bluff typically occurs in the form of toppling block failures with near vertical failure planes that occur from undermining of the toe of the sea cliff during high storm surf events. Bluff retreat is characterized by sudden and catastrophic slope failure that involves the entire bluff as opposed to gradual "grain to grain" erosion and retreat. Bluff retreat has been observed to be temporally episodic due to external factors associated with El Niño-Southern Oscillation events such as those which occurred during the winter of 1997/1998.

Evidence of historic slope failure and coastal bluff retreat is observable along the entire coastal bluff from Agate Beach to Big Lagoon. This section of coastal bluff has a higher potential for slope failure, in general, than many areas of Humboldt County due to (among other factors) the over-steepened sea cliff and easily erodible marine terrace deposits, high annual precipitation, and direct exposure to northwest winter swells coupled with a steep wave slope. An additional contributing factor is the lack of an offshore bar, which would otherwise dissipate wave energy prior to reaching the shoreline. The potential for slope instability and coastal bluff failure to adversely affect the project site is therefore considered to be high. The recommended development setback from the coastal bluff edge, however, is intended to reduce the risks to new developments associated with landsliding to an acceptable level during the 75-year economic lifespan (Mark Johnsson, California Coastal Commission, 2003) of the new structure.

5.5 Flooding

The building footprint is located approximately 30 feet in elevation above the nearest stream channel, consisting of Roundhouse Creek located in excess of 1,000 feet to the south of the southerly property boundary. Therefore, the potential for flooding to impact the new structure is negligible.

5.6 Soil Swelling or Shrinkage Potential

The subsoils at foundation load bearing depths consist of marine terrace and beach deposits composed of non-plastic to low plasticity silty sand grading downward into non-plastic poorly graded sand with silt. Due to the granular nature of the soils, the hazard to the structure associated with potential swelling or shrinkage of these materials beneath the foundation is low.

6.0 RECOMMENDATIONS

6.1 Site Preparation

All undocumented fill soils, topsoil, and any other debris encountered at or below the existing ground surface should be removed at the footing locations. All earthwork should be conducted during dry-weather conditions, if feasible. If wet-weather construction is to occur, earthwork should be conducted in a manner that avoids excessive rutting and mixing of disturbed soils and/or topsoil with the underlying foundation bearing soils.

6.2 Cut and Fill Slopes

Structural fill on sloping ground steeper than 4H:1V should be placed on a suitably prepared "benched" subgrade surface. All structural fills should be compacted mechanically (i.e. engineered) to minimize potential settlement. Due to the building site being nearly level, no new cut or fill slopes are anticipated for the new development as currently proposed.

6.3 Fill Materials

Aggregate Base

Imported aggregate base material should be used beneath footings or floor slabs, and as trench backfill. This material should meet the requirements in the Caltrans Standard Specifications, Class 2 Aggregate Base (3/4 inch maximum particle size).

Select Fill

Select fill may be used as non-expansive fill beneath floor slabs and for the pavement subgrade, if any. Select fill should be a soil/rock mixture free of organic material and other deleterious material. The select fill material should contain low plasticity clay, well-graded sand, and/or gravel. Select fill should contain no rocks larger than 3 inches in greatest dimension, nor more than 15 percent larger than 2 inches. Additionally, the material should meet the following specifications:

Plasticity index:	<12
Liquid Limit:	<30
Percent passing No. 200 sieve:	50 maximum, 5 minimum

6.4 Compaction Standard

Within shallow excavations including utility trenches, it is recommended that "wacker-packers" or vibrating plate compactors be used to achieve the specified compaction standards. Concrete slurry should be used to backfill a utility trench that parallels a footing, where the trench bottom is within a 2H:1V plane, projected outward and downward from any structural element. The use of concrete backfill is not required where a utility trench crosses a footing at/or near a right angle.

It is recommended that structural fill material be compacted as specified below.

Table 2- Structural Fill Placement Specifications

Fill Placement Location	Compaction Recommendation (ASTM D 1557-Modified Proctor)	Moisture Content (Percent Optimum)
Structural fill supporting footings	90%	-1 to +3 percent
Structural fill supporting slabs-on-grade	90%	-1 to +3 percent
Structural fill placed within 3 feet beyond the perimeter of the building pad	90%	-1 to +3 percent
Utility trenches within building and any pavement areas	95%	-1 to +3 percent
Utility trenches beneath landscape and grass areas	90%	-1 to +3 percent

6.5 Seismic Design

We recommend the proposed building be designed and constructed to withstand seismic shaking as required by the CBC. Based on the site conditions as encountered at test locations, we have classified the site as Site Class D consisting of a "stiff soil profile" (Section 1613.5.2, 2010 CBC). On this basis, the design spectral response accelerations Ss, S_1, Fa, Fv, S_{MS}, S_{M1}, S_{DS}, and S_{D1} were determined using the United States Geological Survey (USGS) seismic calculator software, "Seismic Hazard Curves, Response Parameter, Design Parameters: Seismic Hazard Curves and Uniform Hazard Response Spectra", version 5.1.0 dated August 10, 2011, utilizing the American Society of Civil Engineers (ASCE) Standard 7-05, Minimum Design Loads for Buildings and Other Structures analysis option. Calculated values are presented below.

Table 3 - Summary of Seismic Design Factors

Site Class	F_a	Fv	Ss	S_1	S_{MS}	S_{M1}	S_{DS}	S_{D1}
D	1.0	1.5	2.555	1.152	2.555	1.729	1.703	1.152

*Latitude and Longitude of the parcel centroid are 41.1538° and -124.1357°, respectively, based on Humboldt County GIS.

The criteria are defined as follows:

Fa – Short period coefficient to modify 0.2-second period of mapped spectral response accelerations for Site Class other than Site Class B.

Fv – Long period coefficient to modify 1.0-second period of mapped spectral response accelerations for Site Class other than Site Class B.

Ss – Mapped spectral response acceleration, 5 percent damped, at 0.2-second period for Site Class B (in %g).

S_1 – Mapped spectral response acceleration, 5 percent damped, at 1.0-second period for Site Class B (in %g).

S_{MS} – Maximum considered earthquake spectral response acceleration, 5 percent damped, at 0.2-second for Site Class effects (in %g).

S_{M1} – Maximum considered earthquake spectral response acceleration, 5 percent damped, at 1.0-second period for Site Class effects (in %g).

S_{DS} – Design spectral response acceleration, 5 percent damped, at 0.2-second period (in %g).

S_{D1} – Design spectral response acceleration, 5 percent damped, at 1.0-second period (in %g).

6.6 Building Setbacks

All new site developments shall maintain a minimum slope setback of 151 feet, as depicted on the Figure 2. The setback distance is based on the analysis and recommendations provided by Busch Geotechnical Consultants in a report dated November 7, 2006, and prepared for the previous landowners. The Busch report is included as Appendix B for reference. The setback

distance was determined on the basis of a conservative average long-term bluff retreat rate of 1-foot per year multiplied by a 75-year design life, in addition to a 76-foot setback determined from quantitative slope stability modeling using a Factor of Safety equal to 1.5. The cumulative setback distance of 151 feet is based on methodology recommended and approved by the California Coastal Commission.

The physical location of the development setback line at the project site was determined from a surveyed based map prepared by a Licensed Surveyor from our office in August 2010 that is the basis for the Figure 2 site plan. The development setback is measured perpendicular from a straight line projection of the bluff edge, as depicted on Figure 2. It is permissible to cantilever the residence floor over the setback line to provide some flexibility in the design and construction of the new structure.

6.7 Foundation Design

6.7.1 Discussion

The following foundation recommendations assume a single-story residence with conventional wood-framing will be constructed on this site. Soil conditions allow for the proposed structure to be supported on a shallow foundation system that consists of a continuous concrete perimeter foundation in combination with isolated internal spread footings. This type of foundation system will facilitate moving the home in the future, if necessary.

Specific foundation plans were not provided to LACO at the time this Report was prepared. The following recommendations are suitable for foundation support and design, subject to the conditions presented.

- Footing concrete should be placed neat against undisturbed soil. The materials exposed in footing excavations should not be allowed to dry before placing concrete. If shrinkage cracks appear in the footing excavation materials, these materials should be thoroughly moistened to close all cracks prior to concrete placement.
- The foundation system should be designed and constructed in accordance with the minimum standards of the current edition of the 2010 CBC, and the recommendations contained herein.

6.7.2 Depth of Footings

- All footings should be founded on and embedded into the suitably dense granular soils encountered below 2.5 feet of existing grade. The depth of embedment shall at a minimum be designed in accordance with the requirements of the 2010 CBC.
- Alternatively, footings may bear on engineered fill placed on the aforementioned competent native soils.
- Areas where excessive amounts of unsuitable soft soils, woody debris, or stumps are encountered will require special design considerations. To mitigate soft site soils or areas

containing woody debris, and avoid potential differential settlement, the unsuitable material should be excavated and replaced with engineered fill, placed and compacted as recommended herein, or concrete slurry, and backfilled to the footing design depth.

6.7.3 Allowable Soil Bearing Pressures

- For design of foundation elements bearing on and embedded into suitably-dense undisturbed soils encountered below 2.5 feet of existing grade, an allowable bearing pressure of 2,000 pounds per square foot for dead load plus long-term live load, in accordance with Table 1804.A.2 (CBC, 2010) is recommended.
- The allowable bearing pressure may be increased by one-third when using alternate load combinations in Section 1605.3.2 (CBC, 2010) that include wind or earthquake loads.

6.8 Drainage and Erosion Control

The building site should be graded to provide positive drainage away from the foundation elements of the structure. The grading, landscaping, and construction should be such that no water is allowed to pond anywhere on the site, nor to migrate beneath the proposed structure.

- A minimum gradient of three percent should be maintained for all impervious surfaces within 10 feet of the structure.
- A minimum gradient of five percent should be maintained for landscaped areas within 10 feet of the structure.
- All roof storm drainage should be controlled with the installation of gutters and downspouts. Downspouts should be connected to tight-lines to convey roof storm runoff away from a structure to a suitable outlet point.

7.0 ADDITIONAL SERVICES

The conclusions and recommendations provided in this Report are based on the assumption that soil conditions encountered during grading and/or foundation construction will be essentially as exposed during the site evaluation, and that the general nature of the grading and use of the property will be as described above. At the election of the project site owner, LACO can provide inspection services including review of foundation plans and the foundation excavations to assure conformance with the recommendations presented herein.

LACO ASSOCIATES
ENGINEERS · GEOLOGISTS · ENVIRONMENTAL CONSULTANTS

December 16, 2011

7473.00

County of Humboldt
Division of Environmental Health
c/o Dale Winget
1951 Huckleberry Court
Eureka, California 95501

Attention: Adam Molofsky, HCDEH

Subject: Sewage Disposal System Design; New One-Bedroom Single-Family Residence; 254 Roundhouse Creek Road, Big Lagoon, California
Assessor's Parcel Number 517-251-018

Dear Mr. Molofsky:

PROJECT DESCRIPTION

The project consists of the construction of a new one-bedroom, single-family residence at the above referenced location. The parcel is currently vacant. Access to the new residence will be from an existing gravel road along the northerly property boundary, accessed from Roundhouse Creek Road. The footprint of the new home will be located in the southwesterly portion of the parcel. Additional site improvements include vegetation removal and landscaping. All new developments, including the sewage disposal system, will be required to be set back a minimum distance of 151 feet from the top of the coastal bluff, as recommended by Busch Geotechnical Consultants, in a slope stability report dated November 2006 for the project site, and prepared for the previous owners. Currently the parcel located to the west of the project site is owned by Humboldt County, and is rendered undevelopable.

The scope of our investigation includes the designation and design of a new sewage disposal system and 100 percent reserve area to serve the new residence. Per Humboldt County Division of Environmental Health (HCDEH) regulations, the new sewage disposal system is designed and sized for a two-bedroom residence in accordance with the minimum standards.

A Certified Engineering Geologist from our office performed the site septic suitability investigation on November 7, 2011, prior to the start of the Humboldt County wet-weather testing period. Permission to perform the field investigation prior to the wet-weather testing period was granted by David Spinosa of HCDEH, on the basis of known conditions at the project site from previous investigations on nearby projects. Our field investigation included the installation of backhoe test pits to characterize the subsoil conditions and collect depth discrete soil samples for laboratory textural analysis, and to conduct percolation testing. No observation wells were installed due to the lack of soil mottling or groundwater within the upper 10 feet of the soil profile on the day of our field investigation.

PROJECT LOCATION

The parcel is located in the NW ¼ of Section 24, T. 9 N. and R. 1 W., Humboldt Baseline and Meridian, of the Trinidad 7.5-Minute Topographic Quadrangle (Figure 1) on Assessor's Parcel Number 517-251-018 (Figure 2). The site is situated on the west side of Roundhouse Creek Road within privately owned lands of the Big Lagoon subdivision. The property is bordered to the north and south by single-family residences on similarly sized parcels. A private waters services district and local utilities serve the property.

SITE DESCRIPTION

Topography at the project site and surrounding parcels slope to the north at a uniform gradient of about four percent. A fill slope with a grade of 4:1 (horizontal to vertical) associated with the Roundhouse Creek Road fill prism borders the building site along the parcel's easterly boundary. The precipitously steep coastal bluff is located west of the westerly property boundary a horizontal distance ranging from 60 feet to 90 feet.

The project site and adjacent parcel to the west encompassing the coastal bluff crest is currently vegetated with a dense thicket of immature spruce trees. Soils are consistent with marine terrace deposits elsewhere in the local area and consist of organic-rich silt overlying sandy loams to loamy sands. Soils generally appear well drained as the ground surface lacks evidence of concentrated overland flow.

SOIL AND GROUNDWATER CONDITIONS

Soil and groundwater conditions at the site were characterized utilizing backhoe test pits excavated at select locations on November 7, 2011 (Figure 2). Two backhoe test pits, denoted at as TP-1 and TP-2 were excavated to depths of approximately 10 feet bgs within the area encompassing the new primary disposal field and 100 percent reserve area. A third backhoe test pit, denoted as TP-3 was excavated near the westerly building footprint to verify the continuity of the soil profile. Two additional shallow test pits were excavated adjacent to test pits TP-1 and TP-2 to conduct percolation testing. The soil profiles were described in general accordance with USDA standards. Bulk soil samples were collected from discrete depth intervals at anticipated absorption trench depths for laboratory textural analysis. Percolation testing was then conducted within the range of depths at which the soil samples were collected. Soil Profile Logs are included as Attachment 1.

As is common to this area of Big Lagoon, soil horizonation is well developed consisting of a distinct A-horizon and B-horizon, with un-weathered parent material below about 5 feet. The entire soil profile was observed to consist of silt loam grading into sandy loam (Zone 2) beginning at about 2 feet. Below ground surface at approximately 5 feet, soils grade to loamy sand. The upper silt loam horizon is dark brown, very friable with medium to coarse subangular blocky structure, and non-sticky and non-plastic wet consistency. The sandy loam horizon is dark yellowish-brown to yellowish-brown, friable with fine to medium subangular

blocky structure, and slightly sticky and slightly plastic wet consistency. The loamy sand horizon is firm with fine to medium single-grain structure, and non-sticky and non-plastic wet consistency.

No groundwater was encountered to the maximum excavation depth of 10 feet. In general, no distinct soil mottling, indicative of transient groundwater conditions, was observed to the final excavation depth. Very faint mottling was observed in test pit TP-2 at a depth of 5 feet, and is interpreted to represent seasonal wetting and drying of the shallow soils because of wet-season surface infiltration.

LABORATORY TEXTURAL ANALYSIS

Laboratory textural analyses of bulk samples collected from the backhoe test pits were as follows (Attachment 2):

- Test Pit TP-1 at a depth of 3 feet to 5 feet, Sandy Loam (Zone 2)
- Test Pit 2 TP-2 at a depth of 3.5 feet to 5 feet, Sandy Loam (Zone 2)

PERCOLATION TEST DATA

Percolation testing was performed at two locations over the anticipated depths of the absorption trenches. The Soil Percolation Test Sheets are included as Attachment 3.

Two percolation tests were conducted within the general locations of the new primary and reserve areas. The percolation tests were conducted in percolation pits PP-1 and PP-2 at depth intervals of 34 to 46 inches and 30 to 42 inches, respectively.

Measured percolation rates within test pit TP-1 stabilized at a rate of 6 minutes per inch (MPI). Measured percolation rates in test pit TP-2 stabilized at a rate of 8 MPI. For design purposes, and an added factor of safety, the 8 MPI rate was used to size the disposal system. On the basis of the percolation testing, and in accordance with Appendix V, Table V-1, page 44, Humboldt-Del Norte County Department of Public Health Sewage Disposal Regulations (January 1984), the required absorption area per bedroom is 165 square feet.

DISPOSAL SYSTEM DESIGN

Calculations made to determine the size of the disposal system are included as Attachment 4. The project site is located in a rural area with no expectation of any urbanization. Based on the alternative design criteria, a Class D gravity-fed, single-field system with 100 percent replacement area is suitable for this site in accordance with HCDEH standards.

The disposal field is sized to accommodate an effluent loading rate of 300 gallons per day (maximum two-bedroom residence and occupancy) and will require a water-tight, dual-chambered, concrete septic tank with a minimum capacity of 1,200 gallons. A minimum total absorption trench length of 90 feet is required. Three trenches with lengths of 30 feet are

proposed, for a cumulative length of 90 feet (Figure 3). The trenches are to be excavated to a typical width of 1.5 feet (18 inches) and depth of 5 feet, and spaced 10 feet on center. Each trench is to contain 30 feet of 3-inch perforated drainpipe, and backfilled with clean drain rock to 1 foot below grade (Figure 4). The upper 1-foot is to be backfilled with loamy topsoil.

A qualified Licensed Contractor in accordance with the specifications and recommendations contained within this report should perform installation of the disposal system.

Please feel free to call if you have any questions or need additional information.

Sincerely,
LACO Associates

Signature on File

Giovanni A. Vadurro
CEG 2554, Exp. 5/30/13

GAV:tmc

FIGURES AND ATTACHMENTS

Figure 1:	Location Map
Figure 2:	Site Map with existing features and test pit locations
Figure 3:	Disposal System Layout
Figure 4:	Typical Trench Cross-Section

Attachment 1:	Soil Profile Logs
Attachment 2:	Laboratory Textural Analysis Worksheets
Attachment 3:	Soils Percolation Test Data Sheet
Attachment 4:	Disposal System Design Calculations

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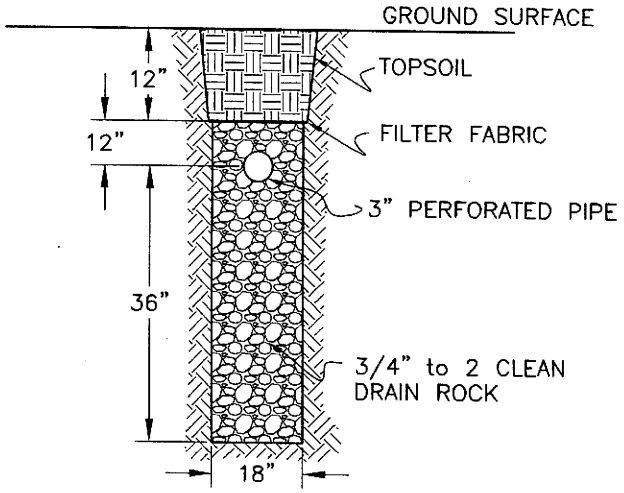

TYPICAL TRENCH CROSS SECTION
SCALE: AS SHOWN

Dec 15,2011-9:25am
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LACO ASSOCIATES CONSULTING ENGINEERS 21 W 4TH ST. EUREKA, CA 95501 (707)443-5054	PROJECT: COASTAL DEVELOPMENT PERMIT	BY: JB	FIGURE: 4
	CLIENT: WINGET PARCEL	DATE: 12/15/11	
	LOCATION: APN 517-251-018	CHECK:	JOB NO.: 7473.00
	TYPICAL TRENCH DIAGRAM	SCALE: AS SHOWN	

ATTACHMENT 4

Disposal Field Design Calculations

CLASS D SEWAGE DISPOSAL SYSTEM DESIGN CALCULATIONS
BASED ON ALTERNATIVE DESIGN CRITERIA
254 Roundhouse Creek Road, Big Lagoon, California
APN 517-251-018
LACO Job No. 7473.00

Setbacks for Primary Disposal Field and 100 Percent Reserve Area:
Property utilizes local community services district water supply
Property Lines: >10 feet
Foundation of Buildings: >10 feet
Wells: >100 feet
Water Main: >15 feet
Ocean, bay and ponds: >100 feet
Perennial Stream: >100 feet
Ephemeral Stream: >50 feet
Springs: >100 feet
Slope Breaks in excess of 30 percent: >25 feet

Design Criteria:
Depth to seasonal high groundwater: >10 feet below ground surface
Soil Textural Analysis: Zone 2, Sandy Loam
Percolation rates: 6 minutes per inch (mpi) to 8 mpi
Proposed number of bedrooms: 1 (design for 2-bedrooms)

Summary of Disposal System Specifications:
Number of Absorption Trenches = **3**
Trench Length (L) = **3 x 30 feet**
Trench Depth (D) = **5 feet (60 inches)**
Trench Width (W) = **1-1/2 feet (18 inches)**
Trench Spacing = **10 feet, center to center**
Perforated Drain pipe:

Use 90 feet of standard 3-inch drain pipe with perforated inverts.

Septic tank:

Use one (1) pre-cast reinforced dual-chambered concrete septic tank with a capacity of 1200 gallons (shall be water tight).

Distribution Box:

Use one (1) concrete distribution box with a minimum of four knockouts (shall be water tight).

Disposal System Design Calculations:

1) Soil loading rate for 2 bedroom occupancy in gallons per day (gpd):
   = 300 gpd

2) Stabilized percolation rate in minutes per inch (MPI):
   6 MPI measured in PP-1 and 8 MPI measured in PP-2
   Use rate of 10 MPI to size both the Primary and 100% Reserve Area fields

3) Absorption Area required for two-bedroom residence based on measured percolation rate (HCDEH Appendix V, Table V-1, pg. 44):
   Use 165 ft^2 per bedroom
   = 2 bedrooms x 165 ft^2 per bedroom
   = 330 ft^2

4) Basic calculation length in feet required using 18" wide gravel filled trenches:
   = Required Absorption Area / 1.5 (HCDEH Appendix V, Table V-2, Pg. 45)
   = 330 ft^2 / 1.5 ft
   = 220 ft

5) Absorption Trench Length required using 36" of gravel below perforated drain pipe:
   = Basic calculation length x 0.41%
   = 220 ft x 0.41
   = 90 ft
   Use 90 feet of absorption trench length
   Distribute effluent flow into three (3) absorption trenches with lengths of 30 feet

6) Disposal System Installation Specifications:
   a) Three (3) absorption trenches with lengths of 30-feet each (see Figure 3);
   b) Trench depths are not to exceed 5-feet (60-inches) and are to be excavated level along the trench bottom (see Figure 4);
   c) Trench width is to be a minimum of 1-1/2-feet (18-inches) (see Figure 4);
   d) Trenches are to be spaced 10-feet apart (center to center);
   e) Each trench is to contain 36" of clean #3 (3/4" to <2") drain rock below the perforated pipe and a minimum of 12" of drain rock covering the pipe (see Figure 4);
   f) Drain rock is to be covered with filter fabric and the trench backfilled with 12" of native topsoil; the topsoil is to be mounded to shed surface runoff and to account for future settlement.
   g) One (1) distribution box required to promote even distribution of effluent to the absorption field trenches;

h) The outlet from the septic tank to the distribution box and from the distribution box to the perforated pipe shall be connected using solid 3-inch high density polyethylene pipe (HDPE).

References:

Sewage Disposal Regulations; Humboldt-Del Norte County Department of Public Health, January 1984.

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SAN FRANCISCO, CA 94105-2219
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28 January 2014

GEOTECHNICAL REVIEW MEMORANDUM

EXHIBIT NO. 9
APPLICATION NO.
1-12-023 – WINGET
GEOTECHNICAL MEMORANDUM FROM DR. MARK JOHNSSON
(1 of 5)

To: Melissa Kraemer, Coastal Program Analyst
From: Mark Johnsson, Staff Geologist
Re: Winget CDP (1-12-023)

In connection with the above-referenced permit application, I have reviewed the following documents:

1) Busch Geotechnical Consultants, 2006, "Recommended setback for a bluff-top home based on erosion-rate and factor-of-safety considerations, 254 Roundhouse Creek Road, Big Lagoon Park subdivision, Humboldt County, California [Lot 18, Melvin, APN 517-251-018]", 27 p. geotechnical report dated 7 November 2006 and signed by B. Whitney, M. Woodward and R. E. Busch Jr. (CEG 1448).

2) LACO Associates, 2011, "Geotechnical Report, New single-family residence, 254 Roundhouse Creek Road, Big Lagoon, California", 12 p. geotechnical report dated 16 December 2011 and signed by G. A. Vadurro (PG 7437).

3) LACO Associates, 2012, "Request for information, Coastal Development Permit Application 1-12-023, Assessor's Parcel Number 517-251-018", 2 p. letter dated 19 November 2012 and signed by B. E. Dussell (CEG 2555).

In addition, I visited the site on 14 March 2013, and have had numerous conversations with the applicant's principal geotechnical consultant, Mr. Bryan Dussell.

Although the subject site is located within a seismically active region, fault rupture hazard and liquefaction potential are considered low (reference 2), and I concur. Ground shaking can be mitigated by adherence to the California Building Code. The earth materials at the site, while easily erodible, do have good bearing capacity and offer adequate foundation support.

The principal geotechnical concern at the site is coastal erosion and slope stability. This is due to a number of factors. These high bluffs are made up entirely of poorly consolidated marine terrace deposits; more resistant bedrock is not encountered until below sea level. Accordingly, waves impact directly the most erodible materials at the site. These waves are not attenuated by offshore rocks or bars. The beach can protect the bluffs from wave attack when it is wide, but it is commonly eroded away during periods of high water or especially strong surf. The area has experienced amongst the greatest short-and long-term coastal erosion events in the state. Griggs et al. (2005) document erosion of 30 to 40 feet during several severe winters between 1935 and 1941, and an additional 30 feet during the 1941-1942 winter. Following a more than three-decade period of milder conditions and less bluff erosion, rapid erosion resumed, and the El Niño

winters of 1982-1983 and 1997-1998 resulted in up to 30 and 50 feet of erosion, respectively. These erosion episodes required the demolition or removal of numerous structures. As described in the findings for a nearby and recently approved Coastal Development Permit (Wilson, CDP 1-12-13):

> The Big Lagoon subdivision has been subject to extraordinary rates of bluff retreat in the past. In the winter of 1997-1998, lots within the subdivision about 1,000 feet north of the subject site [300 feet north of this subject site] experienced catastrophic bluff failure where more than 60 feet of steep bluff retreated during the singular stormy winter. As a result, in 1999, the owners of a nearby home located at 176 Roundhouse Creek Road, which had originally been constructed approximately 50 feet from the bluff edge, as approved by the Commission under CDP 1-87-230 in 1989, applied for a CDP to move the approved house from the original building footprint to a separate inland parcel due to the imminent threat of bluff failure. The Executive Director issued a CDP waiver (1-99-066-W) to authorize the house relocation in September of 1999. In addition, in the spring of 2003, the Executive Director approved emergency permit 1-03-027-G to relocate an existing residence (constructed in 1974 under CDP NCR-74-CC-344) located approximately 600 feet north of the subject site [adjacent to the subject site] and 50 feet from the bluff edge inland to a new foundation approximately 160 feet from the bluff edge (at 294 Roundhouse Creek Rd.). The Commission approved the follow-up CDP for the relocation of this nearby house in December of 2003 under CDP 1-03- 024.

Siting new development to assure stability for its lifetime, as required by Coastal Act section 30253, requires consideration not only of short- and long-term erosion rates, but of the stability of the bluff. The bluff adjacent to this parcel is approximately 125 feet in height and consists of a number of very weak geologic units (reference 1). A quantitative slope stability analysis, with which I concur, finds that a factor of safety against sliding of 1.5, considered the industry standard for definition of stability, is attained at a distance of 76 feet from the bluff edge.

To assure that the development will be set back a sufficient distance to maintain a factor of safety of 1.5 for its potential lifespan, the amount of bluff recession that can be expected over the potential life of this development (often 75 years for residential development in this area) must be estimated. Reference (1) quotes a study by Tuttle (1981) as estimating an historic rate of 1.5 feet per year (ft/yr) for this area. In fact, Tuttle (1981) found historic bluff retreat rates ranging from 1.5 to 2.7 feet per year for sites within this general region (approximately 1200 feet north and south of the site). The analysis in reference (1), using historic aerial photographs, found historic erosion rates of 2.44 ft/yr for the interval 1942-1958; 0.03 ft/yr from 1958 to 1997 and 1 ft/yr from 1997 to 2000. The long term average was 0.75 ft/yr. Reference 1 adopted 1.0 ft/yr as a conservative value, predicting that there would be 75 feet of erosion in the next 75 years.

A total setback to assure a 1.5 factor of safety at the end of the structure's expected life, following a methodology previously used by the Commission and explained in more detail in

Johnsson (2005), would thus be 151 feet. Reference (2) incorporated reference (1) by reference, and recommended this setback.

In accounting for potential increases in bluff erosion rates due to sea level rise, reference (3) recommended that the 76 foot setback necessary to achieve a factor of safety of 1.5 *today* could be considered a buffer to account for such increases. In the decade since Johnsson (2005) was written, much has been learned about sea level rise. I now do not recommend using the slope-stability setback as a buffer that also accommodates increases in bluff retreat due to sea level rise, but rather recommend addressing sea level rise independently. Commission staff's current recommendations can be found in the recently released draft Sea Level Rise Guidance document. Although that document is still subject to revision, it articulates the various methodologies that can be utilized by the Commission in adjusting historic bluff retreat rates for future rising seas:

> There is no fully-accepted methodology for estimating future bluff erosion with sea-level rise. Guidance for coastal analysts in Hawaii is to assume erosion will increase as a proportion of historic erosion. (Hwang, 2005) One approach used in the past by the Commission has been to use the high range of historic erosion rates to represent average future trends. A more process-based methodology, used in the Pacific Institute study of erosion due to rising sea level, is to correlate future erosion rates of bluffs with increased frequency of wave impacts (Heberger et al., 2009; Revell, 2011). This approach assumes that all bluff erosion is due to wave impacts and erosion rates will change over time as the beach or bluff experiences more frequent or more intense wave attack. Such an approach should be considered for examining bluff erosion with rising sea level. Other approaches that recognize the influence of water levels in beach, bluff, or dune erosion can also be used.

The process-based methodology described above is difficult and requires the input of experts with diverse expertise. Further, as it has only been undertaken recently, it is relatively untested. Accordingly, in this case, I recommend using the high range of historic erosion rates to represent average future trends. Since this methodology is based on the use of the high range of historic erosion rather than the long term average erosion rate, this methodology effectively adds to the expected amount of bluff retreat the difference between the long term average erosion rate and the high range of historic erosion rates.

A recent geotechnical report (LACO Associates, 2012) for a nearby parcel (396 Roundhouse Road, approximately 700 feet south of the subject parcel) summarized available data [note that distance from subject site has been adjusted to refer to this subject site]:

Source	*Distance from site*	*Time Span (years)*	*Estimated Retreat Rate (feet per year)*
Tuttle, 1981	*500 and 900 feet South*	*34*	*1.5 to 2.7*
Busch, 2003	*400 feet South*	*61*	*1.0*
LACO, 2006	*200 feet North*	*58*	*1.5*
LACO, 2012	*200 feet South*	*64*	*1.25*

The very high rate of 2.7 ft/yr reported by Tuttle (1981) for a site 900 feet south of the subject site may be an anomaly associated with the gulley that exists near that location. But Tuttle (1981) and LACO (2006) report a rate of 1.5 ft/yr for nearby sites (as shown above) on the same uplifted marine terrace. These sites are located within 500 feet of the project site and are similarly situated as bluff top lots above a uniformly eroded linear bluff face. In my opinion, 1.5 ft/yr is an appropriate rate to use in estimating future bluff retreat. Using the rate of 1.5 ft/yr increases the expected amount of bluff retreat by 37.5 feet as compared to the amount of bluff retreat derived using the 1.0 ft/yr rate recommended in the reference (2), for a total amount of bluff retreat of 112.5 feet over the next 75 years. Combining this amount of expected bluff retreat with the 76-ft setback needed to assure stability against sliding today, as discussed above, results in a total recommended setback of approximately 189 feet from the bluff edge.

By rolling future increases in bluff retreat rates due to sea level rise into the setback needed to assure slope stability, as suggested by reference (3), one is essentially *assuring* that at some point short of its potential life it will be subject to a factor of safety of less than 1.5. By definition, this does not assure stability for the potential life of the development. By taking the highest long-term average historic bluff retreat rate to apply to the future, one is implicitly acknowledging and addressing the effects of sea level rise while at the same time assuring stability for the life of the structure.

I note that, according to the site plans provided by the applicant, it may not be possible to site the proposed structure and the primary and reserve leach fields at this distance from the bluff edge on the parcel. Siting any of these elements closer would simply reduce the amount of time for which safety could be assured. A monitoring condition could be imposed that would require relocation or removal of the development when the bluff edge is close enough that the structure can no longer be considered stable. One approach would be to define stability as a 1.5 factor of safety, which today is found approximately 76 feet from the bluff edge. This figure could change in the future as bluff geometry and exposed soil materials change. Another approach would be to require relocation or removal when the bluff edge is within the distance that could be reasonably expected to be lost in a single storm season, however, this could allow the structure to be maintained with less than full stability. Given past performance of the general area, and especially considering bluff retreat during the El Niño winter of 1997-1998, I would recommend a reasonably conservative trigger of 60 feet be used to determine when the structure should be relocated.

I hope that this review is helpful. Please do not hesitate to contact me with any further questions.

Sincerely,

Signature on File

Mark Johnsson, Ph.D., CEG, CHG
Staff Geologist

Additional References Cited:

Busch Geotechnical Consultants, 2003, "Recommended setback for the Rohner bluff-top home based on an erosion-rate analysis and factor-of-safety considerations, 294 Roundhouse Creek Road, Big Lagoon Park Subdivision, Humboldt County, California [APNs 517-251-14 and 517-251-15]", 32 p. geologic report dated 6 October 2003 and signed by R. E. Busch (CEG 1448), Jr. and B. Dussell.

Griggs, G., Patsch, K., and Savoy, L., 2005, Living with the changing California coast: Berkeley, California, University of California Press, 540 p.

Heberger, M., Cooley, H., Herrera, P., Gleick, P.H., and Moore, E., 2009, The impacts of sea-level rise on the California coast, California Climate Change Center, p. 99.

Hwang, D.J., 2005, Hawaii Coastal Hazard Mitigation Guidebook., University of Hawaii Sea Grant College Program, p. 216.

Johnsson, M.J., 2005, Establishing development setbacks from coastal bluffs, *in* Magoon, O.T., Converse, H., Baird, B., Jines, B., and Miller-Henson, M., eds., California and the World Ocean '02: Revisiting and revising California's Ocean Agenda: Reston, Virginia, American Society of Civil Engineers, p. 396-416.

LACO Associates, 2012, "Slope Setback Recommendation Report, New Single-Family Residence, 396 Roundhouse Creek Road, Big Lagoon, California, Assessor's Parcel Number 517-251-06", 11 p. geotechnical report dated July 30, 2012 and signed by R. E. Yahn (PE 913), B. E. Dussel (CEG 2555) and M. R. Love.

Revell, D.L., Battalio, R., Spear, B., Ruggiero, P., and Vandever, J., 2011, A Methodology for predicting future coastal hazards due to sea-level rise on the California coast: Climatic Change, v. 109 (Supp. 1), p. 251-276.

Tuttle, D.C., 1981, Investigation and methods for determining coastal bluff erosion, historical section., Unpublished Sea Grant Report, 161p

EXHIBIT NO. **10**

APPLICATION NO.

1-12-023 – WINGET

APPROXIMATE SQUARE FOOTAGE OF SURROUNDING HOMES