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5-21-0549

(Los Cerritos Wetlands Authority)

MARCH 11, 2022

EXHIBITS

Exhibit 1 – Vicinity Map

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ANCHOR QEA

Figure 1
Project Site and Vicinity Map
Sampling and Analysis Plan for Southern Los Cerritos Wetlands Restoration Project
Southern Los Cerritos Wetlands Restoration Project

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ANCHOR QEA

Figure 2
Site Map

Sampling and Analysis Plan for Southern Los Cerritos Wetlands Restoration Project
Southern Los Cerritos Wetlands Restoration Project

9700 Research Drive
Irvine, California 926181
949.347.2780

ANCHOR QEA

Memorandum

July 1, 2021

To: Chris Webb, Moffatt & Nichol

From: Michael Whelan, PE, Chris Osuch, and Sam Giannakos, Anchor QEA, LLC

Re: Sampling and Analysis Plan for Southern Los Cerritos Wetlands Restoration Project

Introduction

The Los Cerritos Wetlands Authority (LCWA) is proposing to restore tidal wetlands and other habitats within the South LCWA site (also known as the Hellman Ranch property), which is located in Seal Beach, California (Figure 1). The South LCWA site is part of the Los Cerritos Wetlands Complex (Complex) that comprises approximately 503 acres of publicly and privately owned open space that is mostly degraded tidal and non-tidal salt marsh and upland fill. The LCWA owns approximately 166 acres of the Complex, including the South LCWA site. The South LCWA site is approximately 105 acres and includes former sumps, landfills, and contaminated areas from prior oil operations (Figure 2). Restoration of the South LCWA site is one of the near-term activities identified in the Program Environmental Impact Report (ESA 2020).

The refined restoration plan for the South LCWA site is detailed in *The Los Cerritos Wetlands Habitat Restoration Plan* (CRC 2021) and is presented in Figure 3. As part of this plan, soil will be regraded to create elevations suitable for wetland habitats, a new tidal channel will be excavated, and the existing road through the South LCWA site will be retained with a bridge or culvert constructed at the new channel. The existing road will also be raised to protect against flooding, and a berm or floodwall will be constructed along the northern perimeter of the site for additional flood protection. Excavated soil from the project is planned for on-site reuse or off-site disposal at a suitable location.

A geotechnical and environmental site assessment will be conducted at the South LCWA site to help determine the design for flood management (e.g., berms and flood walls) and the stability of the grading site, to evaluate cut materials to determine their suitability for safe and effective reuse on site, and to evaluate the residual chemical concentrations at the expected new post-excavation soil surface (also known as the Z layer). Information from this assessment will be used to develop the following: 1) an understanding of subsurface physical and geotechnical conditions; and 2) geotechnical engineering recommendations for use in designing earthwork and site improvements.

This Sampling and Analysis Plan documents the procedures and methods that will be used in sampling and testing of soils from the South LCWA site.

Project Description

The Complex, which borders Los Angeles and Orange counties, affords the opportunity to restore salt marsh, seasonal wetlands, and other freshwater wetlands. The Southern California Wetlands Recovery Project, a partnership of 17 state and federal agencies, has identified the acquisition and restoration of the Los Cerritos Wetlands as a high regional priority. The restored habitat will provide multiple benefits, including provision of critical habitat for listed species and other fish and wildlife, carbon sequestration, improved flood control, sea level rise resiliency, preservation of tribal cultural resources, and improved public access to open space.

The Complex adjoins the lower reach of the San Gabriel River where, prior to channelization, the mouth of the river migrated back and forth across the coastal plain. Historically, the Complex covered approximately 2,400 acres and stretched approximately 2 miles inland, varying from freshwater and brackish wetlands in its inland areas to salt marsh closer to the ocean. Channelization of the San Gabriel River began in the 1930s and cut off tidal action to much of the wetland area. The size of the historical wetlands has been reduced by farming, placement of fill and excavation of channels and basins for oil fields and landfill burn dumps, and urban development. There is ongoing oil production throughout the area, and much of the remnant salt marsh is within a grid of dikes, berms, roadways, and levees. The Haynes Cooling Channel, which services an upstream power plant, also bifurcates sections of the Complex. Today, remnants of the historical wetlands occur in degraded patches divided into the following four areas: North, Central, Isthmus, and South.

The LCWA developed the PEIR for the Complex, which analyzed potential impacts of the proposed program (ESA 2020). The PEIR included restoration and public access designs to support environmental review and identified the South LCWA site as one of the near-term projects. The refined restoration plan for the South LCWA site was designed to be less impactful than those plans analyzed in the PEIR, and it includes more details on different salt marsh habitats (CRC 2021).

Review of Previously Collected Data

Several studies were conducted at the site from 1987 to 2006 (BCL Associates 1987; Converse 1996, 1997, 1998a, and 1998b; Geomatrix Consultants 2001; Anchor 2004, 2006a, and 2006b). In 2003, Anchor Environmental and Everest International Consultants conducted a review of previous site investigation reports conducted from 1987 to 2002 (Anchor and Everest 2003). In 2017, Geosyntec performed an environmental review of the Los Cerritos Wetlands, including the South LCWA site, based on existing environmental documentation (Geosyntec 2017). Sampling locations from these studies are presented in Figure 4.

Previous investigations characterized contamination based on the magnitude of concentrations and sources. Identified sources of contamination included oil wells, oil pipelines, petroleum sumps, Area 18 (area where asphalt-like material was stockpiled and buried), and a construction and demolition landfill. Contaminants present at the site included total petroleum hydrocarbons (TPH), metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). The highest TPH concentration measured at the South LCWA site was 149,000 milligrams per kilogram (mg/kg). Lead was identified as the metal likely to be of greatest concern, with concentrations up to 240 mg/kg. PAHs, PCBs, and pesticides have not been analyzed to the same extent as other contaminants. Additional details on previous investigations are provided in environmental reviews conducted by Geosyntec (2017) and Anchor Environmental and Everest International Consultants (2003).

Sampling and Testing Approach

Because the South LCWA site is known to contain residual contaminants as a result of historical oil extraction operations, geotechnical and chemistry data will be collected and evaluated to verify functionality of the restoration design and ensure that future site conditions do not represent a potential threat to human health or ecological receptors. Previous investigations identified several areas with soil contamination at varying depths and magnitudes. A review of previously collected data relative to the revised restoration plan for the site indicates several areas have not been investigated, including the south side of the site where the new tidal channel is proposed. Similarly, the northeastern side of the site—where the berm will be constructed—has not been investigated to determine soil stability to support added fill material. This Sampling and Analysis Plan focuses on evaluating those areas of the South LCWA site with limited data for three primary objectives:

1. Chemically and geotechnically characterize the overlying cut material to determine suitability for safe and effective reuse on site or for off-site disposal.
2. Evaluate the chemical concentrations at the anticipated soil surface that will be exposed after excavation (i.e., the Z layer) to support a design that meets limits of defined human health and ecological risk thresholds in the newly restored environment.
3. Evaluate the existing geotechnical site qualities where berms and other structures (e.g., culverts and/or bridges) will be constructed to determine material strength for supporting the planned structures.

Soil borings will be conducted at 18 stations to adequately characterize the untested portions of the South LCWA site. A combination of techniques will be employed depending on the specific test location. Geotechnical borings will be sampled at 5-foot intervals along the way to test for soil bearing capacity and other strength-related properties. If fine-grained soils are identified during drilling, Shelby tube samples will be collected to test for subgrade consolidation. This information will aid in designing the berm such that it does not settle or slump over time. In areas of the site where material will be removed, continuous borings will be collected to predetermined depths that match the expected cut layer. Chemical and geotechnical properties of the overlying material will be assessed to evaluate the material for reuse in other areas of the site or off-site disposal, as well as other details of the material such as predicted slope stability. A sample will also be collected at the depth that corresponds to the Z layer to determine potential for future risks. Testing of samples will include geotechnical and chemical analyses.

Field Collection Program

Station Locations

Soil borings will be collected from 18 stations for geotechnical and chemical sampling and testing purposes. Proposed sampling locations relative to the refined restoration plan (CRC 2021) and jurisdictional wetlands are presented in Figures 5 and 6, respectively. No samples will be collected from within jurisdictional wetlands. Proposed sampling locations, existing site features, and previously completed sampling locations are presented in Figure 7. Access routes are shown in Figure 8. No sensitive plant communities will be disturbed by sampling or transport of equipment.

Geotechnical sampling locations were chosen to test for physical properties of soils planned for excavation or filling, to estimate soil bearing capacity and other strength-related properties, and to evaluate slope stability of fill and cut slopes. These stations target the new berm, the new culvert or bridge along the existing road, culverts proposed for removal, and the potential landfill cut.

Environmental sampling locations were chosen to represent the physical and chemical characteristics of soils proposed for removal. Environmental borings will be used to evaluate cut material for reuse on site or off-site disposal and to evaluate the Z layer.

Station locations may be adjusted in the field based on conditions encountered (e.g., limited access, refusal during coring operations). Wherever feasible, special status or native vegetation will be avoided to minimize any disturbance. Target coordinates, existing and proposed habitats, existing and proposed elevations, and target boring depths for each station are presented in Table 1.

Table 1
Target Coordinates, Existing and Proposed Elevations, and Target Boring Depths for Proposed Sampling Locations

Core Sample ID	Existing Habitat Type	Proposed Habitat and/or Construction Element	Latitude (Decimal Degrees)[1]	Longitude (Decimal Degrees)[1]	Existing Elevation (feet NAVD88)	Proposed Cut Elevation (feet NAVD88)[2]	Depth of Z Layer Below Proposed Elevation (feet)	Target Boring Depth (feet bgs)[3]	Sampling Equipment
LCW-01	Ruderal uplands	Low intertidal (new channel)	33.751029	-118.103952	8.6	-1.8	0.5	10.9	Hand auger[4]
LCW-02	Ruderal uplands	Cordgrass marsh	33.752402	-118.102136	8.5	2.9	0.5	6.1	Hand auger[4]
LCW-03	Ruderal uplands	Mid marsh	33.751121	-118.102236	8.1	4.3	0.5	4.3	Hand auger
LCW-04	Ruderal uplands	Mid marsh	33.751666	-118.101089	9.9	4.3	0.5	6.1	Hand auger
LCW-05	Ruderal uplands	Mid marsh (landfill cut)	33.749776	-118.102129	13.5	4.3	0.5	9.7	HSA drill rig
LCW-06	Ruderal uplands	Low intertidal (new channel)	33.749962	-118.101875	11.2	-1.8	0.5	13.5	HSA drill rig
LCW-07	Ruderal uplands	Low intertidal (new channel)	33.750203	-118.100135	10.3	-1.8	0.5	12.6	HSA drill rig
LCW-08	Berm between salt flat and southern coastal salt marsh	Mid marsh (berm cut)	33.751556	-118.099809	10.9	4.3	0.5	7.1	Hand auger
LCW-09	Vegetation free zone	Low intertidal (culvert removal)	33.751835	-118.099292	7.1	-1.8	0.5	9.4	HSA drill rig
LCW-10	Ruderal uplands	Mid marsh	33.750852	-118.098689	10.6	4.3	0.5	6.8	HSA drill rig
LCW-11	Ruderal uplands	Low intertidal (new channel)	33.750586	-118.097625	11	-1.8	0.5	13.3	HSA drill rig
LCW-12	Ruderal uplands	Mid marsh	33.750854	-118.096291	12.2	4.3	0.5	8.4	HSA drill rig
LCW-13	Vegetation free zone	Low intertidal (culvert removal)	33.751569	-118.096288	7.6	-1.8	0.5	9.9	HSA drill rig

Core Sample ID	Existing Habitat Type	Proposed Habitat and/or Construction Element	Latitude (Decimal Degrees)[1]	Longitude (Decimal Degrees)[1]	Existing Elevation (feet NAVD88)	Proposed Cut Elevation (feet NAVD88)[2]	Depth of Z Layer Below Proposed Elevation (feet)	Target Boring Depth (feet bgs)[3]	Sampling Equipment
LCW-14	Development	New bridge	33.750619	-118.103914	9.5	--	--	25	HSA drill rig
LCW-15	Development	New berm	33.753027	-118.099959	8.6	--	--	25	HSA drill rig
LCW-16	Ruderal uplands	New berm	33.753416	-118.096962	6.5	--	--	25	HSA drill rig
LCW-17	Ruderal uplands	New berm	33.752100	-118.095007	5.5	--	--	25	HSA drill rig
LCW-18	Ruderal uplands	New berm	33.751745	-118.091871	10.2	--	--	25	HSA drill rig

Notes:

1. Based on NAD83
2. Proposed cut elevation is based on the habitat elevation ranges for full tidal conditions (no muting), as presented in Table 6-1 of The Los Cerritos Wetlands Habitat Restoration Plan (CRC 2021). The lower end of the elevation range was conservatively used.
3. For environmental borings, target boring depth includes the depth to achieve design depth plus Z-layer sample for chemistry borings.
4. A hand auger is required due to limited access.

bgs: below ground surface
HSA: hollow stem auger
NAD83: North American Datum of 1983
NAVD88: North American Vertical Datum of 1988

Sample Collection

Prior to commencing field work, applicable boring permits will be obtained from the Orange County Health Care Agency, Environmental Health Division, along with approvals needed from the California Coastal Commission. Boring locations will be cleared of utilities by contacting Underground Service Alert of Southern California (DigAlert) to create a ticket for the South LCWA site. Participating utilities will identify the location or lack of utility presence. Any necessary site access agreements will be obtained appropriate biological monitoring will be conducted by Tidal Influence, and appropriate archeological monitoring will be provided by Cogstone Resource Management, Inc.

Soil borings will be collected at 18 stations. Deep borings will be collected from 13 stations using a track-mounted limited access hollow stem auger (HSA) drill rig operated by Cascade Drilling, LP. The limited access drill rig sits on two approximately 8-foot-long rubber tracks designed to access difficult terrain, including muddy or sandy areas such as beaches. The drill rig is remotely controlled by the driller, allowing it to maneuver areas with difficult access paths. If required to limit environmental impact of the drill tracks, poly mats can be placed beneath the tracks to limit ground disturbance by the movement of the rig. The drilling team will typically operate between the hours of 7:00 a.m. and 6:00 p.m. or approved permitting hours.

Shallow borings will be collected from five stations using a hand auger. Shallow borings will target areas with limited access for the drill rig or areas with minimal soil proposed for removal. Borings will be collected to the target depths in Table 1 or refusal, depending on conditions in the field. Geotechnical borings will be advanced to a depth of 25 feet below ground surface (bgs), with one advanced to a depth of 100 feet, or rig refusal, for seismic site classification. Standard penetration testing (SPT) will be performed using a standard split spoon sampler at approximately 5-foot intervals to boring termination. For the boring advanced for seismic site classification, SPT will be performed at approximately 10-foot intervals at greater depths. Geotechnical samples will be collected from these split spoon samplers for characterization and strength testing of the soils. If fine-grained soils are identified during drilling, Shelby tube samples will be collected to test for subgrade consolidation. For chemistry testing borings, samples will be collected continuously to the proposed excavation depth and Z layer (0.5 foot beyond proposed excavation depth), which represents the future exposed elevation post-restoration. Target boring depths are presented in Table 1. Station positioning will be accomplished using a differential global positioning system (DGPS) with an accuracy of plus or minus 10 feet. Horizontal positions will be reported in latitude and longitude relative to North American Datum of 1983 (NAD83). Upon completion of drilling, boreholes will be backfilled per Orange County Health Care Agency, Environmental Health Division requirements.

Sample Processing

Soil samples will be field screened for the presence of volatile organic vapors using a photoionization detector and examined for visual indication of the presence of contaminants. The lithology of each core will be recorded on individual boring logs (Appendix A). Representative intervals from each boring will be photographed.

Chemical Samples

VOC samples will be collected from one sample interval at one station per composite prior to homogenization and compositing to minimize loss of volatile constituents during handling. VOC samples will be collected using laboratory-provided volatile organic analysis (VOA) vials. Station and sample intervals for VOCs will be determined in the field based on visual observations and photoionization detector measurements to target samples with the greatest potential for detections.

Soil from each 2-foot interval and the entire length of each boring to the depth of the expected cut will be collected and archived to allow for additional chemical analyses, if necessary. The Z layer from each station, consisting of the 0.5-foot interval below the depth of the expected cut, will also be collected and archived to characterize the newly exposed surface layer. Z-layer archives will be analyzed for a subset of chemicals in coordination with the LCWA based on overlying composite sample results.

Composite samples will be created for chemical analysis. The soil sample compositing scheme and testing strategy is presented in Table 2. Each composite will consist of two stations, and station LCW-05 will be tested individually. Station LCW-05 is located within the historical landfill (Figure 6), so soil quality may be inconsistent with other sampling locations. A proportionate volume of the homogenized soil from each boring, based on relative boring lengths, will be combined to form each composite sample. After completion of compositing, samples will be placed into jars appropriate for physical and chemical analyses, and all jars will be firmly sealed with Teflon-lined lids. A subsample will be collected for particle size analysis by sieve and hydrometer and placed in a high-density polyethylene (HDPE) jar or zip-top bag.

Waterproof sample labels will be filled out with an indelible-ink pen and affixed to the sample jars. Each label will contain the project name, sample identifier, preservation technique, requested analyses, date and time of collection and preparation, and initials of the person preparing the sample. All chemical samples will be temporarily stored in coolers supplied with crushed ice or frozen blue ice packs. Temperatures will be maintained at approximately 4°C, plus or minus 2°C. Archived samples will be stored frozen at less than -10°C for up to 6 months after sample collection.

Geotechnical Samples

For each SPT performed, blow counts will be recorded for each 6-inch interval of the split spoon driven into the subsurface. The data will be used with published equations and relationships to correlate with geotechnical design parameters and approximate characteristics such as material type, undrained shear strength, compressibility, and frictional strength. The split spoon samplers are then retrieved and opened. The percent of recovery will be noted, and lithology will be interpreted in accordance with ASTM D2488 and noted on field log reports. Photographs will be taken of the recovered sediment prior to subsampling. A minimum of one subsurface soil sample will be collected from each distinct stratum of the soil boring and placed into a labeled jar or bag, and the sample intervals and date and time of collection will be recorded. No logging will be done on Shelby tubes; percent recovery will be measured with a tape measure and the tube samples will be capped and the ends sealed. The outside of the Shelby tube will be labeled using a permanent marker with the sample interval, date and time of collection, and orientation (top or bottom).

The filled sample jars or bags and sealed Shelby tubes will be stored at room temperature until delivery to the geotechnical laboratory. The Shelby tubes will be stored upright. The Shelby tubes will be extruded, and samples will be trimmed for testing by the geotechnical test laboratory. Sample handling and transport will be in accordance with ASTM D4220.

Laboratory test assignments will be determined by the field coordinator in consultation with the project geotechnical engineer based on the encountered sediment types (Table 2). Assignments will be based on sample type (disturbed or undisturbed), soil type (fine grained or coarse grained), and observed lithology. One-dimensional consolidation, direct shear strength, and triaxial shear strength testing will only be performed on undisturbed samples.

Table 2
Compositing Scheme and Testing Strategy

Core Sample ID	Composite Sample ID	Archive			Composite Chemical Analysis[1]	Geotechnical Testing		
		2-Foot Interval	Core	Z Layer		Index[2]	SPT	Undisturbed[3]
LCW-01	LCW-01/02	X	X	X	X	--	--	--
LCW-02		X	X	X		--	--	--
LCW-03	LCW-03/04	X	X	X	X	--	--	--
LCW-04		X	X	X		--	--	--
LCW-05	--	X	X	X	X	X	X	--
LCW-06	LCW-06/07	X	X	X	X	X	X	--
LCW-07		X	X	X		--	--	--
LCW-08	LCW-08/09	X	X	X	X	--	--	--
LCW-09		X	X	X		X	X	--
LCW-10	LCW-10/11	X	X	X	X	--	--	--
LCW-11		X	X	X		X	X	--
LCW-12	LCW-12/13	X	X	X	X	--	--	--
LCW-13		X	X	X		X	X	--
LCW-14	--	--	--	--	--	X	X	X
LCW-15	--	--	--	--	--	X	X	X
LCW-16	--	--	--	--	--	X	X	X
LCW-17	--	--	--	--	--	X	X	X

Core Sample ID	Composite Sample ID	Archive			Composite Chemical Analysis[1]	Geotechnical Testing		
		2-Foot Interval	Core	Z Layer		Index[2]	SPT	Undisturbed[3]
LCW-18	--	--	--	--	--	X	X	X
Total Samples		**TBD[4]**	**13**	**13**	**7**	**TBD[5]**		

Notes:

1. VOCs will be collected from one interval at one of the composite stations prior to homogenization and compositing to minimize loss of volatile constituents during handling.
2. Index testing includes but is not limited to moisture content, Atterberg limits, specific gravity, and grain size.
3. Undisturbed testing includes tests performed on Shelby tube samples.
4. To be determined in the field based on boring depths to achieve cut elevation
5. To be determined based on lithologies and conditions encountered in the field

--: not applicable
TBD: to be determined

Sample Identification

Each individual and composite sample will be assigned a unique alphanumeric identifier using the following format:

- The first set of characters identify the site (i.e., LCW for Los Cerritos Wetland).
- The next characters identify the following:
  - The boring location or individual soil sample collected for that boring; these two characters will be 01, 02, and 03, and so on
  - The respective composite sample from multiple borings (i.e., 01/02 for the composite sample from boring locations 01 and 02)
- The next character identifies the Z-layer sample (i.e., Z for Z layer) or the depth interval from which an archive sample was collected, if applicable.
- The remaining characters identify the sampling date (MMDDYY).

Sample Delivery

Chemistry samples will be securely packed inside coolers with ice and shipped to the appropriate laboratory for analysis (Table 3). Geotechnical samples will be packed inside coolers at ambient temperatures. A chain-of-custody (COC) form will accompany each cooler of samples to the analytical laboratories. The COC forms will be the principal documents used to detail the possession and transfer of samples. Each person who has custody of the samples will sign the COC form and ensure that the samples are not unattended unless properly secured.

Table 3
Laboratory Point of Contact and Shipping Information

Laboratory	Analyses Performed	Point of Contact	Shipping Information
Eurofins Calscience, Inc.	Sediment chemistry	Lori Thompson (714) 895-5494	Eurofins Calscience, Inc. 7440 Lincoln Way Garden Grove, California 92841
GeoTesting Express, Inc.	Geotechnical testing	Jon Campbell (978) 893-1291	GeoTesting Express, Inc. 125 Nagog Park Acton, Massachusetts 01720

Field Equipment Decontamination Procedure

Any sampling equipment that cannot be cleaned to the satisfaction of the project manager or designee will not be used for any further sampling activity. The drillers will clean their equipment prior to mobilizing to the site. All sampling equipment exposed to collected soil will be decontaminated between stations using the following procedures:

- Rinse with potable water and wash with scrub brush until free of soil.
- Wash with phosphate-free biodegradable soap solution.
- Rinse with distilled water.

Acid or solvent washes will not be used in the field because of safety considerations and problems associated with rinsate disposal and sample integrity.

Waste Disposal

Soil cuttings, decontamination water, and excess soil sample material generated during borings will be collected and placed into 55-gallon drums suitable for subsequent transportation for off-site disposal at a permitted waste management facility. Waste profiles for any waste stream will be prepared, as required by the waste disposal facility. Filled and partially filled drums will be properly labeled and kept closed. Filled drums will be staged on site until waste characterization is complete. Once properly characterized, the contained waste will be collected and transported to a permitted waste management facility for disposal.

All disposable sampling materials and personnel protective equipment used in sample processing (such as disposable coveralls, gloves, and paper towels) will be placed into heavy-duty garbage bags or other appropriate containers. Disposable supplies will be placed into a normal refuse container for disposal as solid waste.

Laboratory Analyses

Laboratory analysis will include chemical and geotechnical analyses.

Chemical Analysis

Chemical analyses of soil in this testing program were selected to determine the suitability of material for reuse on site and evaluate the chemical concentrations at the expected new soil horizon or Z layer. Chemical analyses of overlying cut material will include total solids, particle size, salinity, total organic carbon (TOC), Title 22 metals, PAHs, organochlorine pesticides, PCB Aroclors, TPH, and VOCs. As previously described, VOC samples will be collected from one interval per location prior to homogenization in order to minimize loss of volatile constituents during handling. Chemical analyses will be conducted by Eurofins Calscience, Inc., located in Garden Grove, California. Particle size analysis will be conducted by GeoTesting Express, Inc., located in Acton, Massachusetts, as described in the Geotechnical Testing section. All analytical methods used will follow U.S. Environmental Protection Agency (USEPA), Standard Method (SM), or ASTM protocols. Table 4 presents the proposed chemical and conventional parameters, recommended analytical methods, and target reporting limit ranges for the evaluation of soil samples. Appropriate containers, holding times, and preservation for each analysis are provided in Table 5.

Table 4
Proposed Conventional and Chemical Parameters, Recommended Analytical Methods, and Target Method Detection and Reporting Limits for Soil Samples

Parameter	Recommended Analytical Method	Units	Target Method Detection Limit[1]	Target Reporting Limit[1]
Physical and Conventional Parameters				
Total solids	SM 2540 B	% wet weight	0.1	0.1
Particle size	D4464	%	0.01	0.01
Salinity	SM 2520 B	psu	2.0	2.0
TOC	USEPA 9060A	%	0.017	0.05
Total Petroleum Hydrocarbons (C6 – C44)	USEPA 8015B	mg/kg	3.85	5.00
Metals				
Antimony	USEPA 6020	mg/kg	1.36	3.00
Arsenic	USEPA 6020	mg/kg	2.26	2.50
Barium	USEPA 6020	mg/kg	0.222	0.500
Beryllium	USEPA 6020	mg/kg	0.171	0.250
Cadmium	USEPA 6020	mg/kg	0.202	0.500
Chromium	USEPA 6020	mg/kg	0.176	1.00
Cobalt	USEPA 6020	mg/kg	0.227	1.00
Copper	USEPA 6020	mg/kg	0.507	1.00
Lead	USEPA 6020	mg/kg	0.967	5.00
Mercury	USEPA 7471	mg/kg	0.0135	0.0833
Molybdenum	USEPA 6020	mg/kg	0.451	0.500

Parameter	Recommended Analytical Method	Units	Target Method Detection Limit[1]	Target Reporting Limit[1]
Nickel	USEPA 6020	mg/kg	0.429	0.500
Selenium	USEPA 6020	mg/kg	1.85	5.00
Silver	USEPA 6020	mg/kg	0.225	1.00
Thallium	USEPA 6020	mg/kg	1.48	5.00
Vanadium	USEPA 6020	mg/kg	0.172	1.00
Zinc	USEPA 6020	mg/kg	5.11	10.0
PAHs				
1-Methylnaphthalene	USEPA 8270C SIM	µg/kg	2.3	10
1-Methylphenanthrene	USEPA 8270C SIM	µg/kg	2.5	10
2,6-Dimethylnaphthalene	USEPA 8270C SIM	µg/kg	1.7	10
2-Methylnaphthalene	USEPA 8270C SIM	µg/kg	2.3	10
Acenaphthene	USEPA 8270C SIM	µg/kg	2.4	10
Acenaphthylene	USEPA 8270C SIM	µg/kg	0.850	10
Anthracene	USEPA 8270C SIM	µg/kg	3.5	10
Biphenyl	USEPA 8270C SIM	µg/kg	1.9	10
Benzo(a)anthracene	USEPA 8270C SIM	µg/kg	2.2	10
Benzo(a)pyrene	USEPA 8270C SIM	µg/kg	1.8	10
Benzo(e)pyrene	USEPA 8270C SIM	µg/kg	2.0	10
Chrysene	USEPA 8270C SIM	µg/kg	2.2	10
Dibenz(a,h)anthracene	USEPA 8270C SIM	µg/kg	2.0	10
Fluoranthene	USEPA 8270C SIM	µg/kg	1.8	10
Fluorene	USEPA 8270C SIM	µg/kg	3.1	10
Naphthalene	USEPA 8270C SIM	µg/kg	3.5	10
Perylene	USEPA 8270C SIM	µg/kg	2.4	10
Phenanthrene	USEPA 8270C SIM	µg/kg	2.2	10
Pyrene	USEPA 8270C SIM	µg/kg	2.2	10
Total PAHs	Calculated	µg/kg	-	-
PCB Aroclors				
Aroclor-1016	USEPA 8082	µg/kg	2.69	10.0
Aroclor-1221	USEPA 8082	µg/kg	2.69	10.0
Aroclor-1232	USEPA 8082	µg/kg	2.69	10.0
Aroclor-1242	USEPA 8082	µg/kg	2.69	10.0
Aroclor-1248	USEPA 8082	µg/kg	2.69	10.0
Aroclor-1254	USEPA 8082	µg/kg	3.03	10.0
Aroclor-1260	USEPA 8082	µg/kg	3.03	10.0
Aroclor-1262	USEPA 8082	µg/kg	3.03	10.0
Aroclor-1268	USEPA 8082	µg/kg	3.03	10.0
Total PCBs	Calculated	µg/kg	-	-

Parameter	Recommended Analytical Method	Units	Target Method Detection Limit[1]	Target Reporting Limit[1]
Pesticides				
2,4-DDD	USEPA 8081A	µg/kg	0.180	1.00
2,4-DDE	USEPA 8081A	µg/kg	0.420	5.00
2,4-DDT	USEPA 8081A	µg/kg	0.0901	1.00
4,4-DDD	USEPA 8081A	µg/kg	0.106	1.00
4,4-DDE	USEPA 8081A	µg/kg	0.145	1.00
4,4-DDT	USEPA 8081A	µg/kg	0.302	1.00
Total DDTs	Calculated	µg/kg	--	--
Aldrin	USEPA 8081A	µg/kg	0.0832	1.00
alpha-BHC	USEPA 8081A	µg/kg	0.129	1.00
beta-BHC	USEPA 8081A	µg/kg	0.335	1.00
delta-BHC	USEPA 8081A	µg/kg	0.136	1.00
gamma-BHC (Lindane)	USEPA 8081A	µg/kg	0.0590	1.00
Chlordane[2]	Calculated	µg/kg	--	--
alpha-Chlordane	USEPA 8081A	µg/kg	0.0657	0.200
gamma-Chlordane (beta-Chlordane)	USEPA 8081A	µg/kg	0.326	1.00
cis-Nonachlor	USEPA 8081A	µg/kg	0.0752	1.00
trans-Nonachlor	USEPA 8081A	µg/kg	0.0584	1.00
Oxychlordane	USEPA 8081A	µg/kg	0.0712	1.00
Dieldrin	USEPA 8081A	µg/kg	0.0727	0.200
Endosulfan I	USEPA 8081A	µg/kg	0.0724	1.00
Endosulfan II	USEPA 8081A	µg/kg	0.0974	1.00
Endosulfan Sulfate	USEPA 8081A	µg/kg	0.0878	1.00
Endrin	USEPA 8081A	µg/kg	0.0875	1.00
Endrin Aldehyde	USEPA 8081A	µg/kg	0.171	1.00
Heptachlor	USEPA 8081A	µg/kg	0.0708	1.00
Heptachlor Epoxide	USEPA 8081A	µg/kg	0.0853	1.00
Toxaphene	USEPA 8081A	µg/kg	2.00	5.00
Volatile Organic Compounds				
1,1,1,2-Tetrachloroethane	USEPA 8260B	µg/kg	14.5	50.0
1,1,1-Trichloroethane	USEPA 8260B	µg/kg	11.7	50.0
1,1,2,2-Tetrachloroethane	USEPA 8260B	µg/kg	27.2	100
1,1,2-Trichloro-1,2,2-trifluoroethane	USEPA 8260B	µg/kg	23.1	500
1,1,2-Trichloroethane	USEPA 8260B	µg/kg	23.2	50.0
1,1-Dichloroethane	USEPA 8260B	µg/kg	14.0	50.0
1,1-Dichloroethene	USEPA 8260B	µg/kg	13.3	50.0
1,1-Dichloropropene	USEPA 8260B	µg/kg	19.4	100
1,2,3-Trichlorobenzene	USEPA 8260B	µg/kg	50.0	100

Parameter	Recommended Analytical Method	Units	Target Method Detection Limit[1]	Target Reporting Limit[1]
1,2,3-Trichloropropane	USEPA 8260B	µg/kg	21.0	100
1,2,4-Trichlorobenzene	USEPA 8260B	µg/kg	20.5	100
1,2,4-Trimethylbenzene	USEPA 8260B	µg/kg	30.0	100
1,2-Dibromo-3-Chloropropane	USEPA 8260B	µg/kg	338	500
1,2-Dibromoethane	USEPA 8260B	µg/kg	10.3	50.0
1,2-Dichlorobenzene	USEPA 8260B	µg/kg	12.5	50.0
1,2-Dichloroethane	USEPA 8260B	µg/kg	13.8	50.0
1,2-Dichloropropane	USEPA 8260B	µg/kg	13.8	50.0
1,3,5-Trimethylbenzene	USEPA 8260B	µg/kg	30.0	100
1,3-Dichlorobenzene	USEPA 8260B	µg/kg	12.6	50.0
1,3-Dichloropropane	USEPA 8260B	µg/kg	14.8	50.0
1,4-Dichlorobenzene	USEPA 8260B	µg/kg	15.3	50.0
2,2-Dichloropropane	USEPA 8260B	µg/kg	13.6	250
2-Butanone	USEPA 8260B	µg/kg	226	1000
2-Chlorotoluene	USEPA 8260B	µg/kg	12.6	50.0
2-Hexanone	USEPA 8260B	µg/kg	154	1000
4-Chlorotoluene	USEPA 8260B	µg/kg	12.1	50.0
4-Methyl-2-pentanone	USEPA 8260B	µg/kg	145	1000
Acetone	USEPA 8260B	µg/kg	492	1000
Benzene	USEPA 8260B	µg/kg	12.9	50.0
Bromobenzene	USEPA 8260B	µg/kg	10.4	50.0
Bromochloromethane	USEPA 8260B	µg/kg	22.2	100
Bromodichloromethane	USEPA 8260B	µg/kg	7.96	50.0
Bromoform	USEPA 8260B	µg/kg	66.1	250
Bromomethane	USEPA 8260B	µg/kg	329	1000
cis-1,2-Dichloroethene	USEPA 8260B	µg/kg	16.9	50.0
cis-1,3-Dichloropropene	USEPA 8260B	µg/kg	17.4	50.0
Carbon disulfide	USEPA 8260B	µg/kg	20.0	500
Carbon tetrachloride	USEPA 8260B	µg/kg	15.0	50.0
Chlorobenzene	USEPA 8260B	µg/kg	13.4	50.0
Chloroethane	USEPA 8260B	µg/kg	75.0	100
Chloroform	USEPA 8260B	µg/kg	29.5	50.0
Chloromethane	USEPA 8260B	µg/kg	76.9	1000
Dibromochloromethane	USEPA 8260B	µg/kg	13.6	100
Dibromomethane	USEPA 8260B	µg/kg	15.3	50.0
Dichlorodifluoromethane	USEPA 8260B	µg/kg	22.7	100
Di-isopropyl ether (DIPE)	USEPA 8260B	µg/kg	25.0	50.0
Ethanol	USEPA 8260B	µg/kg	3300	12500

Parameter	Recommended Analytical Method	Units	Target Method Detection Limit[1]	Target Reporting Limit[1]
Ethylbenzene	USEPA 8260B	µg/kg	10.3	50.0
Ethyl-t-butyl ether (ETBE)	USEPA 8260B	µg/kg	11.8	50.0
Isopropylbenzene	USEPA 8260B	µg/kg	30.0	50.0
Methylene Chloride	USEPA 8260B	µg/kg	156	500
Methyl-t-Butyl Ether (MTBE)	USEPA 8260B	µg/kg	9.39	100
Naphthalene	USEPA 8260B	µg/kg	261	500
n-Butylbenzene	USEPA 8260B	µg/kg	10.5	50.0
N-Propylbenzene	USEPA 8260B	µg/kg	30.0	100
o-Xylene	USEPA 8260B	µg/kg	30.0	50.0
m,p-Xylene	USEPA 8260B	µg/kg	23.7	100
p-Isopropyltoluene	USEPA 8260B	µg/kg	35.0	50.0
sec-Butylbenzene	USEPA 8260B	µg/kg	30.0	50.0
Styrene	USEPA 8260B	µg/kg	35.0	50.0
trans-1,2-Dichloroethene	USEPA 8260B	µg/kg	15.0	50.0
trans-1,3-Dichloropropene	USEPA 8260B	µg/kg	14.0	100
Tert-amyl-methyl ether (TAME)	USEPA 8260B	µg/kg	9.71	50.0
tert-Butyl alcohol (TBA)	USEPA 8260B	µg/kg	349	1000
tert-Butylbenzene	USEPA 8260B	µg/kg	12.7	50.0
Tetrachloroethene	USEPA 8260B	µg/kg	11.2	50.0
Toluene	USEPA 8260B	µg/kg	30.0	50.0
Trichloroethene	USEPA 8260B	µg/kg	19.3	100
Trichlorofluoromethane	USEPA 8260B	µg/kg	13.6	500
Vinyl acetate	USEPA 8260B	µg/kg	196	500
Vinyl chloride	USEPA 8260B	µg/kg	18.9	50.0
Xylenes, Total	USEPA 8260B	µg/kg	30.0	100

Notes:

1. Target method detection limits and reporting limits are listed in wet weight.
2. Total chlordane is calculated using the following compounds: alpha-Chlordane (cis-chlordane), gamma-Chlordane (trans-chlordane), oxychlordane, cis-Nonachlor, and trans-Nonachlor.

µg/kg: micrograms per kilogram
psu: practical salinity unit

Table 5
Container Requirements, Holding Times, and Preservation Methods

Parameter	Sample Size	Container Size and Type	Holding Time	Sample Preservation Technique
Particle size, moisture content, Atterberg limits, density, and specific gravity	7,750 g	One 1-gallon zip-top bag	None established	None required
All other geotechnical testing	24 inches, 2-inch diameter	One Shelby tube provided by drilling contractor	None established	Cap, seal, and store upright
Particle size (sieve and hydrometer) associated with chemistry samples	500 g	16-ounce HDPE jar or zip-top bag	None established	None required
Salinity	100 g	4-ounce glass	28 days	Cool/4°C
Total solids	10 g	8-ounce glass	None established	Cool/4°C
TOC	50 g	From total solids container	28 days	Cool/4°C
			6 months	Freeze/-18°C
Metals	50 g	From total solids container	6 months	Cool/4°C
			28 days for mercury	
			2 years (except mercury)	Freeze/-18°C
PAHs	30 g	16-ounce glass	14 days until extraction	Cool/4°C
			1 year until extraction	Freeze/-18°C
			40 days after extraction	Cool/4°C
Organochlorine pesticides	30 g	From PAH container	14 days until extraction	Cool/4°C
			1 year until extraction	Freeze/-18°C
			40 days after extraction	Cool/4°C
PCB Aroclors	30 g	From PAH container	14 days until extraction	Cool/4°C
			2 years until extraction	Freeze/-18°C
			40 days after extraction	Cool/4°C
VOCs	5 g	Three 40-mL VOA vials	14 days	Field Preserved Cool/4°C
	10 g	2-ounce Septa	14 days	Cool/4°C
TPH	30 g	From SVOC container	14 days until extraction	Cool/4°C
			1 year until extraction	Freeze/-18°C
			40 days after extraction	Cool/4°C
			1 year until extraction	Freeze/-18°C
			40 days after extraction	Cool/4°C

Notes:
g: gram
mL: milliliter

Geotechnical Testing

Selected samples will be analyzed for physical and geotechnical properties to inform design evaluations related to soil placement and removal across the South LCWA site. Geotechnical testing will be conducted by GeoTesting Express. Selected samples will be analyzed for some or all of the following tests:

- Moisture content ASTM D2216
- Particle size (sieve and hydrometer) ASTM D6913 and D7928
- Atterberg limits ASTM D4318
- Specific gravity ASTM D854
- Bulk density ASTM D7263
- Consolidation ASTM D2435
- Flexible wall permeability ASTM D5084
- Unconsolidated undrained triaxial ASTM 2850
- Direct shear test ASTM 3080
- Unconfined Compression Strength ASTM D2166

The test that is assigned to each sample will depend on the sample location, lithology, and collection method. Testing for index properties will be used to classify soils. Bulk density will be used to analyze material to be excavated. Consolidation testing is used to aid in assessment of the consolidation of fine-grained materials. Strength testing for geotechnical evaluations will be performed using either the unconsolidated undrained (UU) triaxial tests, the direct shear test, or the unconfined compression strength test to develop strength properties of fine-grained material. Atterberg limits will be assigned to cohesive soils that exhibit plastic behavior. Appropriate containers for geotechnical testing are presented in Table 5.

Quality Assurance/Quality Control

For chemical samples, laboratory quality control (QC) procedures, where applicable, include initial and continuing instrument calibrations, standard reference materials (SRMs), laboratory control samples (LCSs), duplicates, matrix spike (MS) and matrix spike duplicate (MSD) samples, surrogate spikes (for organic analyses), and method blanks. Table 6 lists the frequency of analysis for laboratory QC samples, and Table 7 summarizes the data quality objectives for precision, accuracy, and completeness. No QC samples are associated with geotechnical testing.

Results from QC samples in each group will be reviewed by the analyst immediately after a sample group has been analyzed. QC sample results will then be evaluated to determine if control limits have been exceeded. If control limits are grossly exceeded in the sample group, the quality assurance manager will be contacted immediately and corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

Table 6
Frequency of Analysis for Laboratory Quality Control Samples

Analysis Type	Initial Calibration	Ongoing Calibration	LCS/SRM[1]	Duplicates	MS	MSD[2]	Method Blanks	Surrogate Spikes
Total solids	Each batch[3]	N/A	N/A	1 per 20 samples	N/A	N/A	N/A	N/A
Salinity	Each batch	1 per 10 samples	1 per 20 samples	1 per 20 samples	N/A	N/A	1 per 20 samples	N/A
TOC	Daily or each batch	1 per 20 samples	1 per 20 samples	N/A	1 per 20 samples	1 per 20 samples	1 per 20 samples	N/A
Metals	Daily	1 per 10 samples	1 per 20 samples	N/A	1 per 20 samples	1 per 20 samples	1 per 20 samples	N/A
PAHs	As needed[4]	Every 12 hours	1 per 20 samples	N/A	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
TPH	As needed[4]	Every 12 hours	1 per 20 samples	N/A	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
Pesticides/PCBs	As needed[4]	1 per 20 samples	1 per 20 samples	N/A	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
VOCs	As needed[4]	Every 12 hours	1 per 20 samples	N/A	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample

Notes:

1. When an SRM is available, it may be used in lieu of an LCS.
2. An MSD may be analyzed in lieu of a sample duplicate.
3. Calibration and certification of drying ovens and weighing scales are conducted biannually.
4. Initial calibrations are considered valid until the continuing calibration no longer meets method specifications. At that point, a new initial calibration is performed.

N/A: not applicable

Table 7
Data Quality Objectives for Soil and Sediment Samples

Parameter	Precision (Replicates and MSDs)	Accuracy (LCS and MS Recoveries)	Completeness
Total solids	± 20% RPD	N/A	95%
Salinity	± 20% RPD	80% to 120% R	95%
TOC	± 20% RPD	75% to 125% R	95%
Metals	± 30% RPD	75% to 125% R	95%
PAHs	± 35% RPD	50% to 150% R	95%
TPH	± 35% RPD	50% to 150% R	95%
PCBs	± 35% RPD	50% to 150% R	95%
Pesticides	± 35% RPD	50% to 150% R	95%
VOCs	± 35% RPD	50% to 150% R	95%

Notes:
% R: percent recovery
RPD: relative percent difference

Data Analysis

To evaluate potential future impacts to human health and terrestrial and aquatic receptors, results of chemical analyses will be compared to suitable reference values developed in coordination with the stakeholder resource agencies. In some instances, these could be effects range low (ERL) and effects range median (ERM) values developed by Long et al. (1995) for use with marine sediments. The effects range values are helpful in assessing the potential significance of elevated sediment-associated contaminants of concern in conjunction with biological testing.[1] For certain pesticide compounds (i.e., chlordane and dieldrin), the ERL is so low as to make it largely impractical to detect them using routine analytical procedures. Accordingly, having non-detect results that are greater than ERL values or method detection limits would not require re-analysis.

For evaluation of future site conditions to terrestrial receptors, suitable screening criteria may include toxicity reference values (TRVs) or other screening values developed for other regional restoration sites such as the Otay Floodplain and Salt Pond project and the Bolsa Chica Wetlands.

Potential future human health impacts would likely include comparison to California Department of Toxic Substances Control modified screening levels (DTSC-SLs; DTSC 2020). DTSC-SLs were

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[1] Briefly, these values were developed from a large dataset where results of both benthic organism effects (e.g., toxicity tests and benthic assessments) and chemical concentrations were available for individual samples. To derive these guidelines, chemical values for paired data demonstrating benthic impairment were sorted in ascending chemical concentration. The 10th percentile of this rank order distribution was identified as the ERL value, and the 50th percentile was identified as the ERM value.

developed based on USEPA Regional Screening Levels to evaluate human health risk at California sites.

Geotechnical Analysis and Evaluation

Anchor QEA will use the data collected from the investigation, along with other relevant available site data from previous investigations and site surveys, to perform geotechnical engineering analyses of the proposed site improvements. Site data obtained during the geotechnical aspects of the investigation will be used to designate soil engineering parameters for use in geotechnical engineering analyses. The following analyses are anticipated to be performed:

- Estimate bearing capacity, settlement, and slope stability and provide design recommendations for containment berms to be installed around the South LCWA site and other areas where fill will be placed.
- Evaluate slope stability of excavated slopes along the proposed tidal channel alignment.
- Evaluate the physical and moisture condition of soils to be excavated and placed elsewhere on site as fill, so that recommendations can be developed relating to fill placement, moisture conditioning, and compaction.
- Perform a seismic analysis as it relates to slope stability and liquefaction of the subsurface.

Reporting

A data report will be prepared to document the results of sampling, testing, and analysis. Laboratory reports, copies of field forms, sample photographs, and data validation reports will be included as appendices. At a minimum, the following will be included:

- Summary of field activities
- Locations of soil sampling stations in latitude and longitude relative to NAD83
- Project map with actual sampling locations
- Summary of soil chemistry results compared to appropriate screening levels
- Summary of geotechnical testing results

In addition, a drilling completion report will be prepared and submitted to the Orange County Health Care Agency, Environmental Health Division, as required.

References

Anchor and Everest (Anchor Environmental and Everest International Consultants, 2003. *Review of Environmental Site Investigation Reports and Recommendations for Future Evaluations, Hellman Ranch Property, Seal Beach, California*, June 2003.

Anchor (Anchor Environmental), 2004. *Hellman Ranch Supplemental Environmental Site Investigation*. April 2004.

Anchor, 2006a. Memorandum to: Mary Small. Regarding: Bryant Property Document Review. May 22, 2006.

Anchor, 2006b. *Hellman Ranch Groundwater Assessment*, June 2006.

BCL Associates, 1987. *Environmental Site Audit and Field Investigation*, June 1987.

CRC (Coastal Restoration Consultants), 2021. *The Los Cerritos Wetlands Habitat Restoration Plan*. Final Draft. Prepared for Los Cerritos Wetlands Authority and ESA. March 2021.

Converse (Converse Environmental West), 1996. *Interim Progress Report Environmental Site Assessment and Review*. December 1996.

Converse, 1997. *Addendum to Soils Report Binder, Volume 1, Additional Assessment of Oil Field Sumps and Fill Area*. May 1997.

Converse, 1998a. *Site Investigation Report – Southern California Edison Right-of-Way*. January 1998.

Converse, 1998b. *Corrective Action Plan (Soil Placement Plan)*. March 1998.

DTSC (California Department of Toxic Substances Control), 2020. *Human Health Risk Assessment (HHRA) Note Number 3, DTSC-modified Screening Levels (DTSC-SLs)*. June 2020.

ESA, 2020. *Los Cerritos Wetlands Restoration Plan; Final Program Environmental Impact Report*. State Clearinghouse Number 2019039050. Prepared for Los Cerritos Wetlands Authority. October 2020.

Geomatrix Consultants, 2001. *Report of Environmental Site Investigations at the Hellman Ranch Property, Seal Beach, California*. August 2001.

Geosyntec, 2017. Technical Memorandum. *Environmental Review – LCWA Phase I and Phase II Parcels, Los Cerritos Wetlands Restoration*. January 27, 2017.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder, 1995. "Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." *Environmental Management* 19:81–97.

Figures

LEGEND:

- Bioswale/Riparian Woodland
- Camissoniopsis Mitigation Site
- Camissoniopsis Preservation Site
- Existing Tidal Channel
- Flood Wall or Berm
- High Salt Marsh
- High Salt Marsh - Salt Panne
- Mid Salt Marsh
- Raise and Re-align 1st Street on Fill Dirt
- Restore Upland on Fill
- Spartina Salt Marsh
- Subtidal Channel
- To Be Determined
- Tidal Mesocosm
- Transition Zone
- Upland
- Upland on Fill

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ANCHOR QEA

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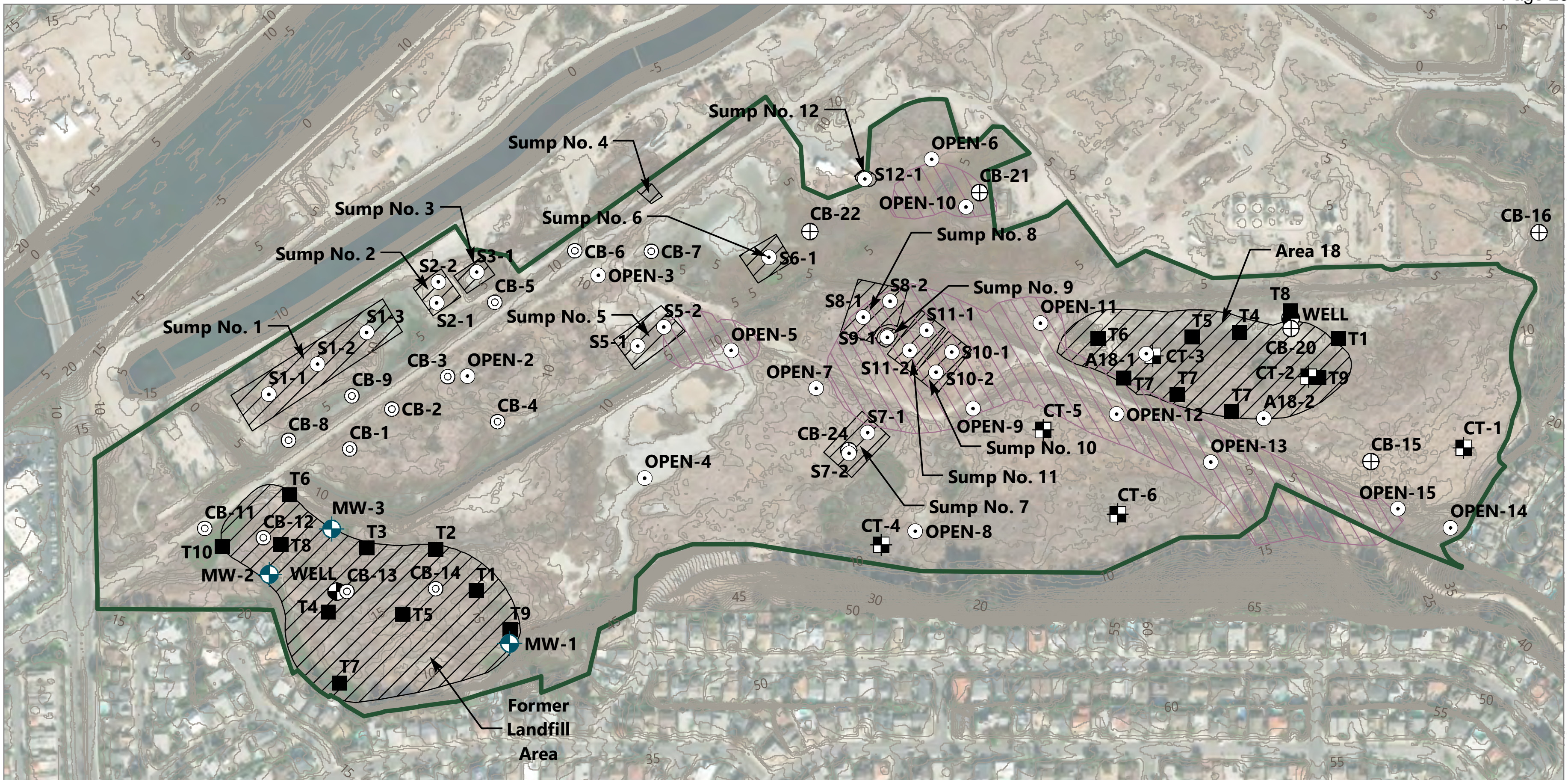
Feet

Figure 3
Los Cerritos Wetlands Habitat Restoration Plan
Sampling and Analysis Plan for Southern Los Cerritos Wetlands Restoration Project
Southern Los Cerritos Wetlands Restoration Project



LEGEND:

- Soil Boring for Agronomy Study (Converse 1996)
- Trench (Geomatrix Consultants 2001)
- Groundwater Monitoring Well (Geomatrix Consultants 2001)
- Test Pit for Agronomy Study (Converse 1996)
- Monitoring Well (Converse 1996)
- Boring Location (Anchor 2004)
- Monitoring Well (Anchor 2004)
- Project Area
- Other Delineated Areas of Contamination (Geosyntec 2017)
- Sumps and Former Landfill
- Topographic Contours (1 foot interval NAVD88)

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Feet

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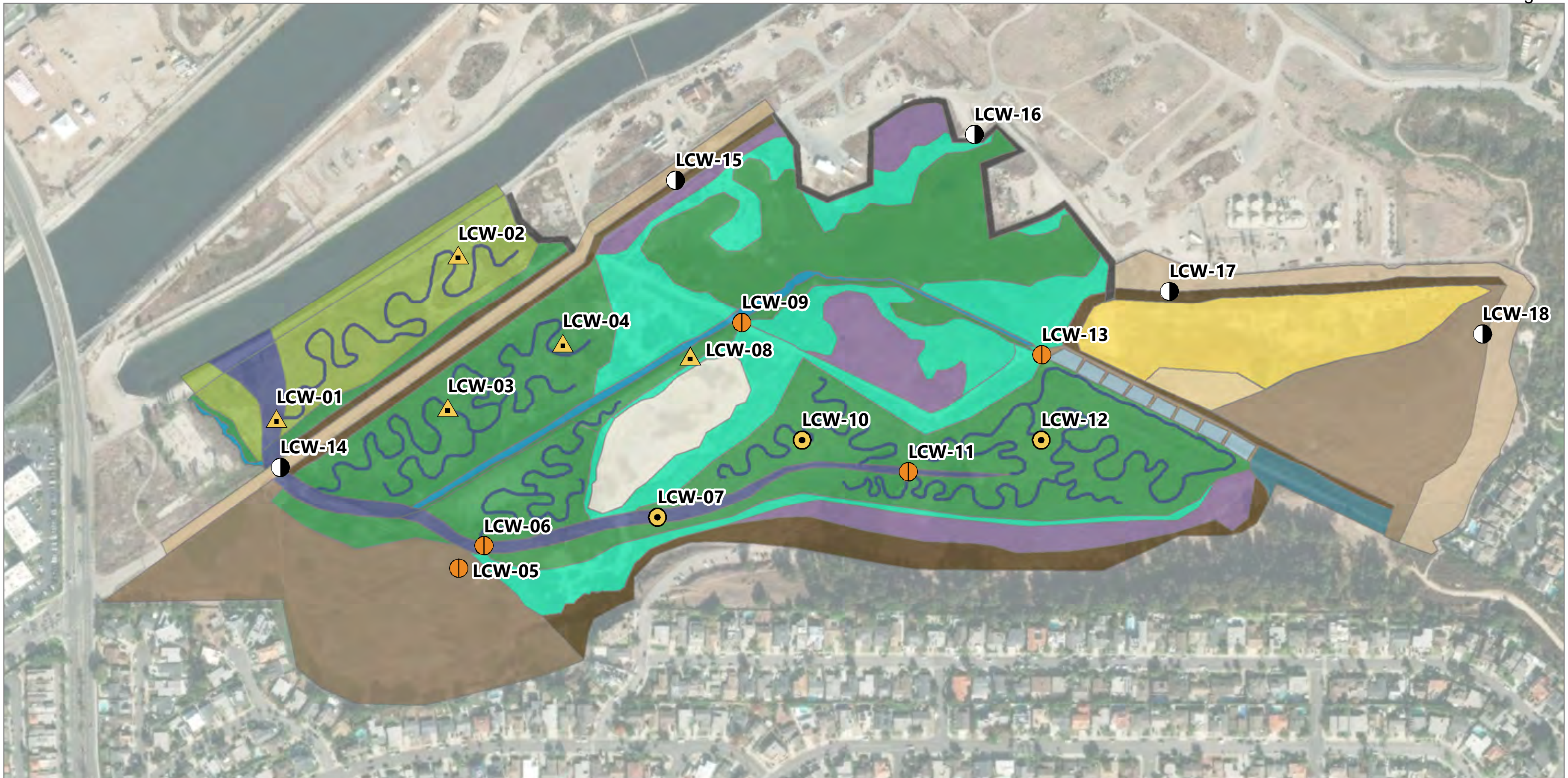
Figure 4
Previously Completed Sample Locations
Sampling and Analysis Plan for Southern Los Cerritos Wetlands Restoration Project
Southern Los Cerritos Wetlands Restoration Project



LEGEND:

- Soil Boring: Chemical Sampling Only (HSA Drill Rig)
- Soil Boring for Chemical Sampling Only (Hand Auger)
- Soil Boring: Geotechnical Purposes Only (HSA Drill Rig)
- Soil Boring: Geotechnical Purposes with Chemical Sampling (HSA Drill Rig)
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- Upland on Fill

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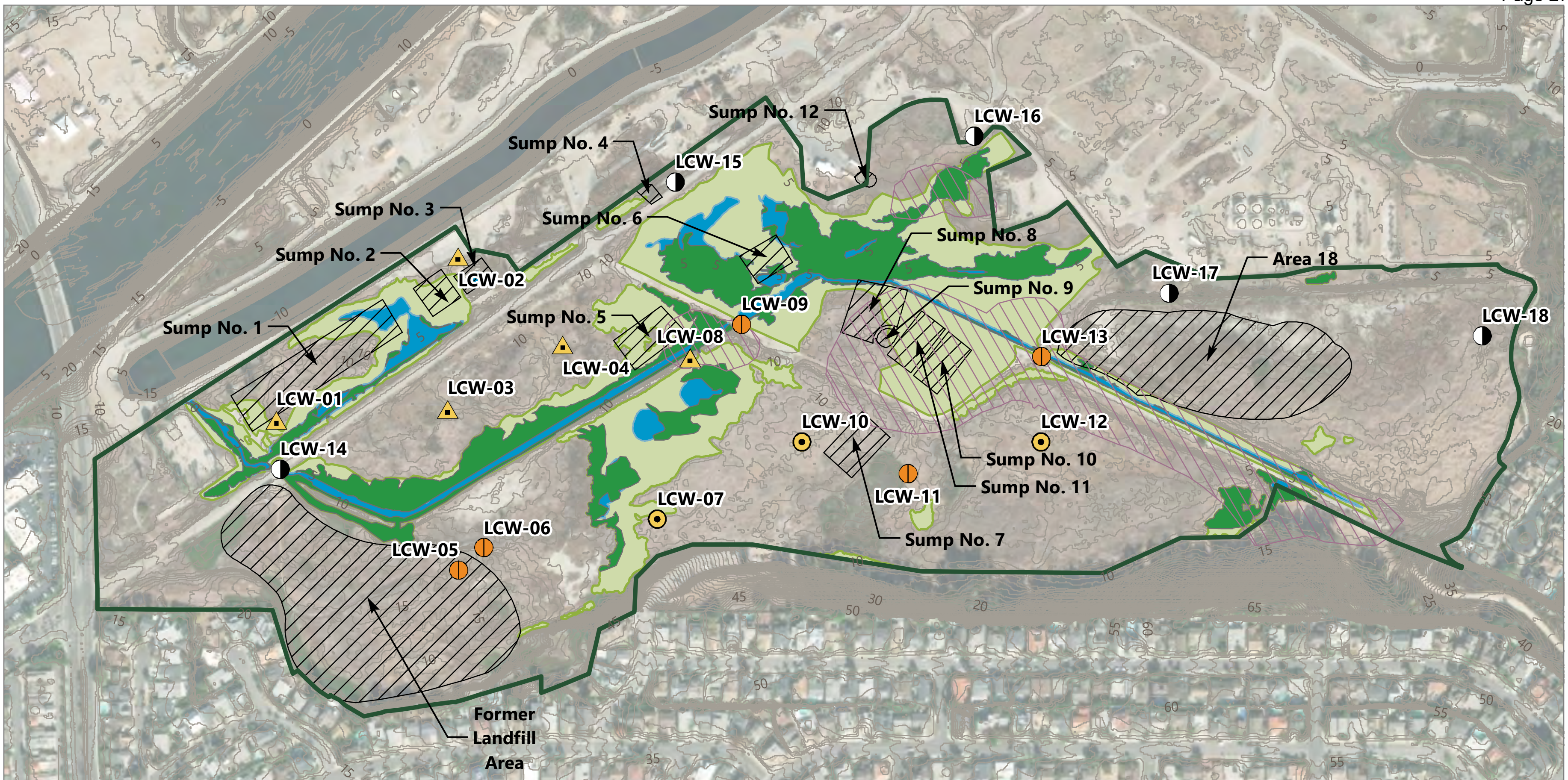
Feet

Figure 5
Proposed Sampling Locations Relative to Restoration Plan
Sampling and Analysis Plan for Southern Los Cerritos Wetlands Restoration Project
Southern Los Cerritos Wetlands Restoration Project



LEGEND:

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- Soil Boring for Chemical Sampling Only (Hand Auger)
- Soil Boring: Geotechnical Purposes Only (HSA Drill Rig)
- Soil Boring: Geotechnical Purposes with Chemical Sampling (HSA Drill Rig)
- Project Area
- Other Delineated Areas of Contamination (Geosyntec 2017)
- Sumps and Former Landfill
- Topographic Contours (1 foot interval NAVD88)
- Jurisdictional Wetlands of the United States
- Jurisdictional Waters of the United States
- California Coastal Commission Wetlands

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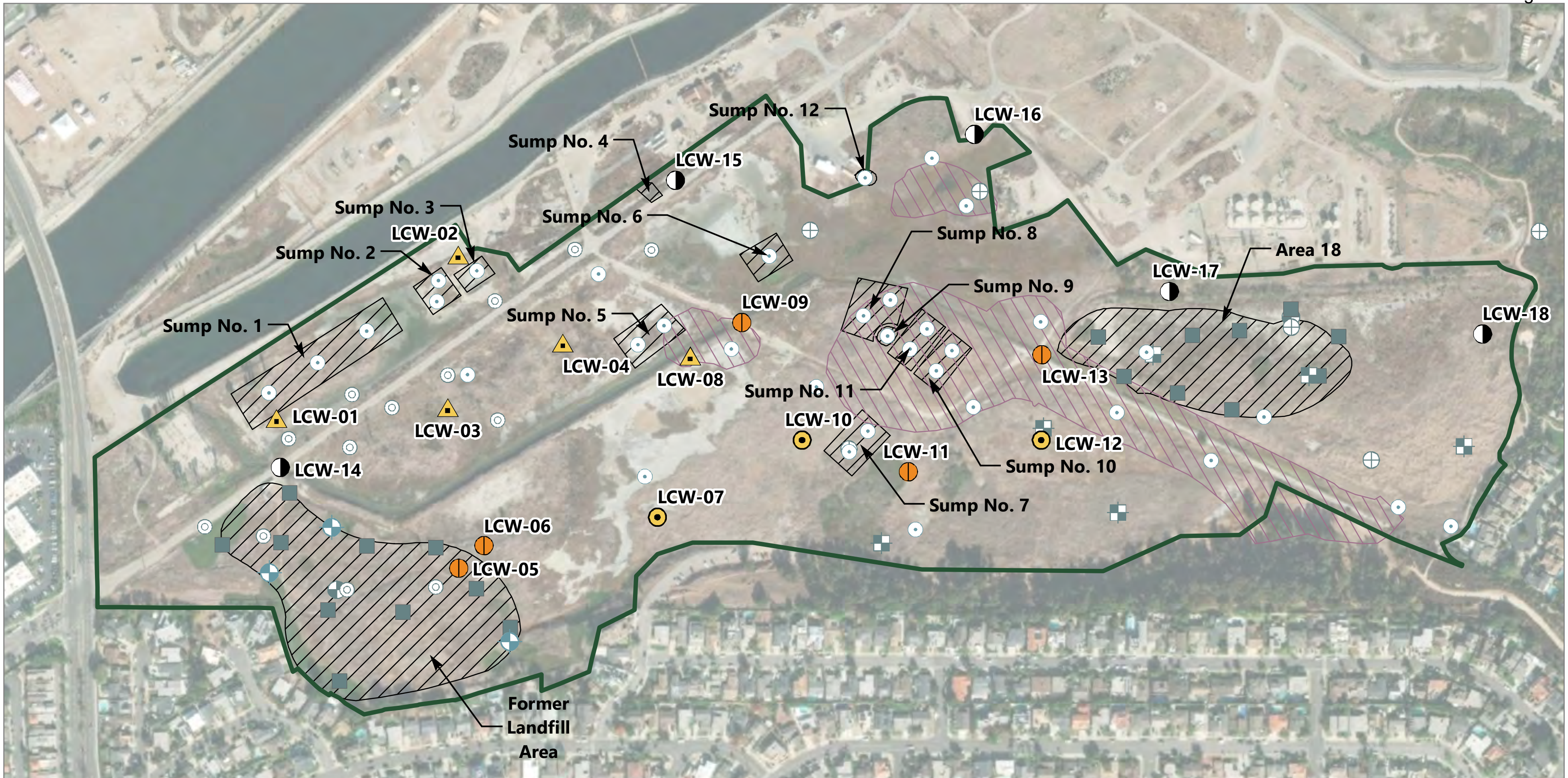
Figure 6
Proposed Sampling Locations Relative to Jurisdictional Waters and Wetlands
Sampling and Analysis Plan for Southern Los Cerritos Wetlands Restoration Project
Southern Los Cerritos Wetlands Restoration Project



LEGEND:

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- Soil Boring for Chemical Sampling Only (Hand Auger)
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- Sumps and Former Landfill

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ANCHOR QEA

0 500
Feet

Figure 7
Proposed Sampling Locations and Site Features
Sampling and Analysis Plan for Southern Los Cerritos Wetlands Restoration Project
Southern Los Cerritos Wetlands Restoration Project

LEGEND:

- Soil Boring: Chemical Sampling Only (HSA Drill Rig)
- Soil Boring for Chemical Sampling Only (Hand Auger)
- Soil Boring: Geotechnical Purposes Only (HSA Drill Rig)
- Soil Boring: Geotechnical Purposes with Chemical Sampling (HSA Drill Rig)
- Project Area
- Topographic Contours (1 foot interval NAVD88)
- Existing Road Access
- Drill Rig Access
- Foot Path Access

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ANCHOR QEA

0 500
Feet

Figure 8
Proposed Access Routes
Sampling and Analysis Plan for Southern Los Cerritos Wetlands Restoration Project
Southern Los Cerritos Wetlands Restoration Project

Appendix A
Boring Log

ANCHOR QEA

LOG OF EXPLORATORY BORING

CLIENT/PROJECT NAME________________ BORING #________
PROJECT NUMBER________________ DATE BEGAN________
GEOLOGIST/ENGINEER________________ DATE COMPLETED________
DRILLING CONTRACTOR________________ TOTAL DEPTH________
DRILLING METHOD________________ SHEET______OF______
HOLE DIAMETER________________

OTHER*	WELL OR PIEZOMETER DETAILS	SAMPLING DATA: SAMPLING METHOD	SAMPLE NUMBER	FID / PID (ppm)	RECOVERY (feet)	BLOWS / 6 INCHES	DEPTH SAMPLED	DEPTH IN FEET	SOIL GROUP SYMBOL (USCS)	Field location of boring / LITHOLOGIC DESCRIPTION
								1		
								2		
								3		
								4		
								5		
								6		
								7		
								8		
								9		
								0		
								1		
								2		
								3		
								4		
								5		
								6		
								7		
								8		
								9		
								0		

Remarks:

This sea level rise and storm scenario report summarizes model results for the area you selected. This report was designed to provide information to help you identify vulnerabilities to sea level rise and storm surges.

Area and Elevation Information

Area is the size of selected polygon, in square meters, acres and hectares, and Elevation is the average, minimum and maximum elevation from the Digital Elevation Model (DEM) within the polgyon.

Area: 569,035.15 m²
140.61 ac
56.90 ha

Projected Percent Area Flooded for the Selected Area

Values indicate the percentage of the selected area flooded for the Storm and Sea Level Rise Scenario combination. Areas of open water are included in these percentages.

Storm Scenario		none	25 cm	50 cm	75 cm	100 cm	125 cm	150 cm	175 cm	200 cm	250 cm	300 cm	500 cm
	100 yr Storm	n/a	n/a	n/a	n/a	89.9%	94.2%	97.9%	100%	100%	n/a	n/a	100%
	20 yr Storm	n/a	n/a	n/a	n/a	n/a	n/a	93.3%	97%	99.8%	n/a	n/a	100%
	Annual Storm	n/a	n/a	n/a	n/a	n/a	n/a	92.1%	96.1%	99.6%	n/a	n/a	100%
	No Storm	n/a	n/a	n/a	n/a	n/a	n/a	89.6%	94.1%	98.1%	n/a	n/a	100%
		Sea Level Rise Scenario											

under 25% flooded
25-50% flooded
50-75% flooded
over 75% flooded

Exhibit 3 – CoSMoS Analysis

California Coastal Commission
5-21-0549
Exhibit 3
Page 1 of 2

Mother's Beach
Whole Foods Market
Trader Joe's
MARINA
2nd St
Westminster Blvd.
Hampton Inn & Suites Seal Beach
Bayshore Beach
NAPLES
Shake Shack
AIM Sports Group
Boeing
Original Parts Group
Appian Way
San Pedro Fish Market - Long Beach
Pat's Pumpkin Patch
Temporarily closed
Seal Beach Animal Care Center
E Ocean Blvd
Schooner Or Later
Seal Beach Blvd
Alamitos Peninsula
Naval Weapons Station Seal Beach RV Park
N Marina Dr
Eaves Seal Beach
PENINSULA
Gum Grove Park
Boathouse on the Bay
Ballast Point Brewing Long Beach
Marina Dr
BRIDGEPORT
Alamitos Park
The Pacific Inn
CVS
Pavilions
JH McGaugh Elementary School
The Crema Cafe
Parking At Seal Beach Jetty
Mahé
Seal Beach
Seal Beach Pier Playground
Seal Beach National Wildlife Refuge