

Water Quality Management Plan (WQMP)

Project Name & Address:

Costa Mesa Fire Station 2

800 Baker Street

Costa Mesa, CA 92626

Prepared for:

City of Costa Mesa

77 Fair Drive

Costa Mesa, CA 92626

Prepared by:

civTEC

Thomas Carcelli, P.E. (C-81640)

999 Corporate Dr., Suite 100

Ladera Ranch, CA 92694

949-463-8822

tec@civtec.net

June 9, 2026

CITY OF COSTA MESA
ENGINEERING DIVISION

- ☒ APPROVED
- ☐ APPROVED AS CORRECTED
- ☐ REVISE AND RESUBMIT
- ☐ REJECTED
- ☐ FOR INFORMATION ONLY

BY CHIRA_M

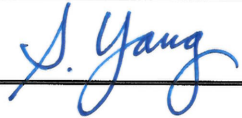
DATE 6/11/2026

Priority Project Water Quality Management Plan (WQMP)
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Project Owner's Certification			
Planning Application No. (If applicable)	N.A.	Grading Permit No.	BPCG-25-0036
Tract/Parcel Map and Lot(s) No.	APN 418-012-29	Building Permit No.	-
Address of Project Site and APN - 800 Baker Street, Costa Mesa, CA 92626 (If no address, specify Tract/Parcel Map and Lot Numbers)			

This Water Quality Management Plan (WQMP) has been prepared for the City of Costa Mesa by civTEC. The WQMP is intended to comply with the requirements of the County of Orange NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan, including the ongoing operation and maintenance of all best management practices (BMPs), and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

Owner: City of Costa Mesa			
Title	Seung Yang, City Engineer		
Company	City of Costa Mesa		
Address	77 Fair Dr., Costa Mesa, CA 92626		
Email	Seung.yang@costamesaca.gov		
Telephone #	(714) 754-5633		
I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein.			
Owner Signature			Date 5/18/2026

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Preparer (Engineer): Thomas E. Carcelli			
Title	Principal	PE Registration #	C-81640
Company	civTEC		
Address	999 Corporate Dr., Suite 100, Ladera Ranch, CA 92694		
Email	tec@civtec.net		
Telephone #	949-463-8822		
I hereby certify that this Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R8-2009-0030/NPDES No. CAS618030, of the Santa Ana Regional Water Quality Control Board.			
Preparer Signature		Date	June 9, 2026
Place Stamp Here			

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Attachments

Attachment A..	 Site Plan
Attachment B..	Simple Design Capture Volume Sizing Method
Attachment C..	OC TGD Exhibits/Worksheets/Calculations
Attachment D .	 Operation and Maintenance (O & M) Plan
Attachment E..	Geotechnical Report (for reference only)

Section I Permit(s) and Water Quality Conditions of Approval or Issuance

Provide discretionary or grading/building permit information and water quality conditions of approval, or permit issuance, applied to the project. If conditions are unknown, please request applicable conditions from staff. *Refer to Section 2.1 in the Technical Guidance Document (TGD) available on the OC Planning website (ocplanning.net).*

Project Information			
Permit/ Application No. (If applicable)	N.A.	Grading Permit No. (If applicable)	BPCG-25-0036
Address of Project Site (or Tract Map and Lot Number if no address) and APN	800 Baker Street 418-121-29		
Water Quality Conditions of Approval or Issuance			
Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.)	Conditions of approval have not been issued at this time. Water Quality conditions of approval will be provided in the final WQMP.		
Conceptual WQMP			
Was a Conceptual Water Quality Management Plan previously approved for this project?	No, this report is the conceptual WQMP.		
Watershed-Based Plan Conditions			

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Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	N/A
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Section II Project Description

II.1 Project Description

Provide a detailed project description including:

- Project areas;
- Land uses;
- Land cover;
- Design elements;
- A general description not broken down by drainage management areas (DMAs).

Include attributes relevant to determining applicable source controls. *Refer to Section 2.2 in the Technical Guidance Document (TGD) for information that must be included in the project description.*

Description of Proposed Project				
Development Category (From Model WQMP, Table 7.11-2; or -3):	Category 8 - Significant Redevelopment Projects			
	All significant redevelopment projects, where significant redevelopment is defined as the addition of 5,000 or more square feet of impervious surface on an already developed site, and the existing development or redevelopment project falls under another Priority Project Category. If the redevelopment results in the addition or replacement of less than 50 percent of the impervious area on-site and the existing development was not subject to WQMP requirement, the numeric sizing criteria discuss below only applies to the addition or replacement area. If the addition or replacement accounts for 50 percent or more of the impervious area, the Project WQMP requirements apply to the entire development.			
Project Area (ft ²): 34,520	Number of Dwelling Units: 0		SIC Code: 9224	
Project Area	Pervious		Impervious	
	Area (sq ft)	Percentage	Area (sq ft)	Percentage
Pre-Project Conditions	1,853	5.4	32,667	94.6
Post-Project Conditions	1,810	5.2	32,710	94.8

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Drainage Patterns/Connections	<u>Existing Condition:</u> The front of the building facing Baker Street sheet flows out to the street, while the rest of the site sheet flows to the north toward Randolph Avenue. Runoff sheet flows out to Randolph Avenue via driveway and enters the catch basin just east of the driveway. The catch basin is connected to the 24-inch RCP storm drain. <u>Proposed Condition:</u> Under the proposed condition, the entire site will drain to the existing 24-inch RCP storm drain in Randolph Avenue. Catch basins, inlets and trench drain are proposed throughout the entire site will collect the runoff and route to the proposed Modular Wetlands System (MWS) for treatment prior to discharging off-site. The building roof drains will also be routed to the MWS unit.
Narrative Project Description:	The City of Costa Mesa proposes replacing the existing fire station with a new fire station. The new fire station includes a new building, trash enclosure, emergency generator, and the parking lot. All the existing improvements, including the building will be demolished.

II.2 Potential Stormwater Pollutants

Determine and list expected stormwater pollutants based on land uses and site activities. *Refer to Section 2.2.2 and Table 2.1 in the Technical Guidance Document (TGD) for guidance.*

Pollutants of Concern			
Pollutant	Check One for each: E=Expected to be of concern N=Not Expected to be of concern		Additional Information and Comments
Suspended-Solid/ Sediment	E ☒	N ☐	
Nutrients	E ☒	N ☐	
Heavy Metals	E ☒	N ☐	
Pathogens (Bacteria/Virus)	E ☒	N ☐	
Pesticides	E ☒	N ☐	
Oil and Grease	E ☒	N ☐	
Toxic Organic Compounds	E ☒	N ☐	
Trash and Debris	E ☒	N ☐	

II.3 Hydrologic Conditions of Concern

Determine if streams located downstream from the project area are potentially susceptible to hydromodification impacts. *Refer to Section 2.2.3.1 in the Technical Guidance Document (TGD) for North Orange County or Section 2.2.3.2 for South Orange County.*

☐ No – Show map

☒ Yes – Describe applicable hydrologic conditions of concern below. *Refer to Section 2.2.3 in the Technical Guidance Document (TGD).*

Per Figure XVI.3 of the Orange County Technical Guidance Document (TGD), the project site is in the potential areas of erosion, habitat & physical structure of susceptibility.

Per Section IV.1.2 of the OC TGD, the simple runoff coefficient method is used to compare the runoff volume between the existing and the proposed conditions. For the time of concentration comparison, 2-year hydrology studies are performed. See the calculations in Attachment C.

Per calculation, the differences are less than 5% therefore, the proposed development does not create a hydrologic conditions of concern.

Volume:

Existing condition – 1,855 CF Proposed condition – 1,857 CF Difference - 0.11% increase

Time of concentration:

Existing condition – 5.0 minutes Proposed condition – 6.86 minutes Difference – 37.2% increase (per Footnote 8 under Section 2.2.3.1 of the NOC TGD, this is acceptable)

II.4 Post Development Drainage Characteristics

Describe post development drainage characteristics. *Refer to Section 2.2.4 in the Technical Guidance Document (TGD).*

Under the proposed condition, the entire site will drain to the existing 24-inch RCP storm drain in Randolph Avenue. Catch basins, inlets and trench drain are proposed throughout the entire site will collect the runoff and route to the proposed Modular Wetlands System (MWS) for treatment prior to discharging off-site. The building roof drains will also be routed to the MWS unit.

II.5 Property Ownership/Management

Describe property ownership/management. *Refer to Section 2.2.5 in the Technical Guidance Document (TGD).*

The property is owned and maintained by the City of Costa Mesa. The City will be responsible for the maintenance of the BMPs.

Section III Site Description

III.1 Physical Setting

Fill out table with relevant information. *Refer to Section 2.3.1 in the Technical Guidance Document (TGD).*

Name of Planned Community/Planning Area (if applicable)	N/A
Location/ Address	800 Baker Street
	Costa Mesa, CA 92626
General Plan Land Use Designation	Institutional
Zoning	I & R – Institutional & Recreational
Acreage of Project Site	0.79 acres (disturbed)
Predominant Soil Type	Soil Type D per Figure XVI-2a, NRCS Hydrologic Soils Group of TGD.

III.2 Site Characteristics

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. *Refer to Section 2.3.2 in the Technical Guidance Document (TGD).*

Site Characteristics	
Precipitation Zone	0.75 inches

Topography	The site is very flat with elevations ranging from 38 to 41 feet.
Drainage Patterns/Connections	Under the proposed condition, the entire site will drain to the existing 24-inch RCP storm drain in Randolph Avenue. Catch basins, inlets and trench drain are proposed throughout the entire site will collect the runoff and route to the proposed Modular Wetlands System (MWS) for treatment prior to discharging off-site. The building roof drains will also be routed to the MWS unit.
Soil Type, Geology, and Infiltration Properties	Per Figure XVI-2a of the OC TGD, the project site has Type D soils, and per the recommendations in the project soils report by Leighton Consulting, Inc., dated July 25, 2024, the infiltration at the project site is not feasible.
Hydrogeologic (Groundwater) Conditions	Groundwater was encountered during the field exploration by the soils engineer at depths of approximately 24 to 25 feet below the existing surface, but the mapped historical high groundwater table within the project area and encountered fine grained soils (clays and silts) render the infiltration infeasible for the project per the recommendations in the soils report.
Geotechnical Conditions (relevant to infiltration)	The mapped historical high groundwater table within the project area (compared to approximately 24-25 feet below surface during site exploration) and encountered fine grained soils (clays and silts) render the infiltration infeasible for the project per the recommendations in the soils report.
Off-Site Drainage	There is no off-site drainage.
Utility and Infrastructure Information	The project site is currently developed as fire station with utilities such as water, sewer, electrical and gas services.

III.3 Watershed Description

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. *Refer to Section 2.3.3 in the Technical Guidance Document (TGD).*

Receiving Waters	Santa Ana-Delhi Channel, Upper Newport Bay, Lower Newport Bay
303(d) Listed Impairments	Santa Ana-Delhi Channel: None Upper Newport Bay: Chlordane, Copper, DDT, Indicator Bacteria, Malathion, Nutrients, PCBs, Sedimentation/Siltation, Toxicity Lower Newport Bay: Chlordane, Copper, DDT, Indicator Bacteria, Nutrients, PCBs, Toxicity

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Applicable TMDLs	Upper Newport Bay: Chlordane, DDT, Indicator Bacteria, Nutrients, PCBs, Sedimentation/Siltation Lower Newport Bay: Chlordane, DDT, Indicator Bacteria, Nutrients, PCBs
Pollutants of Concern for the Project	Suspended Solids, Sediment, Nutrients, Heavy Metals, Pathogens, Pesticides, Oil & Grease, Toxic Organic Compounds, Trash and Debris
Environmentally Sensitive and Special Biological Significant Areas	The project site is not located within an environmentally sensitive and special biological significant areas.

Section IV Best Management Practices (BMPs)

IV. 1 Project Performance Criteria

(NOC Permit Area only) Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis?		YES ☐	NO ☒
If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities.	N/A		

Project Performance Criteria	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	Based on the calculations provided in Attachment C, the proposed project does not create a hydrologic conditions of concern.

List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)	Based on the Model WQMP Section 7.II-2.4.3, the following performance criteria for LID implementation have been established for the North Orange County Permit. Priority Projects must infiltrate, harvest and use, evapotranspire, or biotreat/biofilter the 85th Percentile, 24-Hour storm event (Design Capture Volume). For the proposed project, the 85th Percentile, 24-Hr design storm depth is 0.75 inches. A properly designed biotreatment system may only be considered if infiltration, harvest and use, and evapotranspiration (ET) cannot be feasibly implemented for the full DCV. If a project cannot be designed to infiltrate and/or harvest and use the full DCV, all applicable HSCs must be considered (ET is a principal process in all HSCs). Infiltration, harvest and use, and ET practices must be implemented to the greatest extent feasible and biotreatment may be provided for the remaining DCV. Modular Wetlands System (Biotreatment BMP) will be used to treat the runoff.
List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP)	Per 7.II-3.2.2 of the Model WQMP, if the LID performance criteria are not feasibly met by retention and/or biotreatment, then sizing of onsite treatment control BMPs are required. Sizing of these treatment control BMPs will include, if applicable, any Water Quality credits as calculated per the Technical Guidance Document. If treatment control BMPs can treat all of the remaining unmet volume and have a medium to high effectiveness for reducing the primary POCs, the project is considered to be in compliance; a waiver application and participation in an alternative program is not required. If the cost of providing treatment control BMPs greatly outweighs the pollution control benefits, a waiver of treatment control and LID requirements can be requested.
Calculate LID design storm capture volume for Project.	The project site has one drainage management area (DMA). Design Capture Volume = 1,857 CF (See Worksheet B in Attachment C) Treatment Flowrate = 0.177 cfs (See Worksheet D in Attachment C)

IV.2. Site Design and Drainage

The project site is currently developed as a fire station, and the redevelopment will maintain the current use, thus minimizing the opportunity to minimize the impervious area. The landscape areas are proposed wherever possible to promote incidental infiltration. The building was designed to provide the proper functionality of a fire station. The existing drainage pattern was retained as much as possible while providing the LID treatment. Due to the limited landscape areas as well as the recommendations by the project geotechnical engineer, the infiltration is not feasible, limiting opportunity for retention of runoff onsite. The landscape areas in front and back of the site are not routed to the MWS unit. However the only pollutants of concern from these areas are nutrients and pesticides, which should be mitigated by the judicious use of fertilizers and herbicides as managed by BMPs S₃ and N₄.

See Section VI for the WQMP Site Plan.

See Worksheet B in Attachment C for the Design Capture Volume (DCV) calculations.

There is only one drainage management area (DMA) for the project site, and a modular wetlands system (MWS) unit is proposed for LID treatment control BMP. GIS Coordinate: 33.681095 Lat./-117.889922 Long.

IV.3 LID BMP Selection and Project Conformance Analysis

Each sub-section below documents that the proposed design features conform to the applicable project performance criteria via check boxes, tables, calculations, narratives, and/or references to worksheets. *Refer to Section 2.4.2.3 in the Technical Guidance Document (TGD) for selecting LID BMPs and Section 2.4.3 in the Technical Guidance Document (TGD) for conducting conformance analysis with project performance criteria.*

IV.3.1 Hydrologic Source Controls (HSCs)

If required HSCs are included, fill out applicable check box forms. If the retention criteria are otherwise met with other LID BMPs, include a statement indicating HSCs not required.

Name	Included?
Localized on-lot infiltration	☐
Impervious area dispersion (e.g. roof top disconnection)	☐
Street trees (canopy interception)	☐
Residential rain barrels (not actively managed)	☐
Green roofs/Brown roofs	☐
Blue roofs	☐
Impervious area reduction (e.g. permeable pavers, site design)	☐
Other:	☐

The project site is a fire station. Due to its nature and the limited site area available, landscape areas are very limited (5.2% of the project site). This renders localized on-lot infiltration and impervious area dispersion infeasible. Residential rain barrels are not applicable as this is not residential project. The roof drains are connected directly to the storm drain system per the California Plumbing Code requirements. Green roofs and blue roofs are not considered due to added structural support requirements which would result in significant additional cost to the project. Permeable pavers are not considered as the site soil is Type D.

IV.3.2 Infiltration BMPs

Identify infiltration BMPs to be used in project. If design volume cannot be met, state why.

Name	Included?
Bioretention without underdrains	☐
Rain gardens	☐
Porous landscaping	☐
Infiltration planters	☐
Retention swales	☐
Infiltration trenches	☐
Infiltration basins	☐
Drywells	☐
Subsurface infiltration galleries	☐
French drains	☐
Permeable asphalt	☐
Permeable concrete	☐
Permeable concrete pavers	☐
Other:	☐
Other:	☐

Per Figure XVI-2a of the OC TGD, the project site has Type D soils, and per the recommendations in the project soils report by Leighton Consulting, Inc., dated July 25, 2024, the infiltration at the project site is not feasible.

See Infiltration BMP Feasibility Worksheet in Attachment C.

IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

If the full Design Storm Capture Volume cannot be met with infiltration BMPs, describe any evapotranspiration and/or rainwater harvesting BMPs included.

Name	Included?
All HSCs; See Section IV.3.1	☐
Surface-based infiltration BMPs	☐
Biotreatment BMPs	☐
Above-ground cisterns and basins	☐
Underground detention	☐
Other:	☐
Other:	☐
Other:	☐

Per Worksheet J in Attachment C, the harvest and reuse are not feasible. Since both infiltration and harvest and use are not feasible, biotreatment BMP is utilized to meet the design capture volume.

The project site is a fire station. Due to its nature and the limited site area available, landscape areas are very limited (5.2% of the project site). This renders localized on-lot infiltration and impervious area dispersion infeasible. Residential rain barrels are not applicable as this is not residential project. The roof drains are connected directly to the storm drain system per the California Plumbing Code requirements. Green roofs and blue roofs are not considered due to added structural support requirements which would result in significant additional cost to the project. Permeable pavers are not considered as the site soil is Type D

IV.3.4 Biotreatment BMPs

If the full Design Storm Capture Volume cannot be met with infiltration BMPs, and/or evapotranspiration and rainwater harvesting BMPs, describe biotreatment BMPs included. Include sections for selection, suitability, sizing, and infeasibility, as applicable.

Name	Included?
Bioretention with underdrains	☐
Stormwater planter boxes with underdrains	☐
Rain gardens with underdrains	☐
Constructed wetlands	☐
Vegetated swales	☐
Vegetated filter strips	☐
Proprietary vegetated biotreatment systems	☒
Wet extended detention basin	☐
Dry extended detention basins	☐
Other:	☐
Other:	☐

Since infiltration and harvest and reuse are not feasible, a biotreatment BMP (Modular Wetlands System) is proposed. An 8x8 MWS unit (Model MWS-L-8-8-V) is proposed to treat the runoff before it is discharged offsite. A typical detail is shown on the WQMP Site Map in Section VI. Based on the sizing calculation, design flowrate is 0.177 cfs. Proposed MWS unit has a treatment capacity of 0.231 cfs. A sizing calculation (Worksheet D – Capture Efficiency Method for Flow-Based BMPs) is provided in Attachment C.

The MWS unit is a certified trash full capture system per the State Water Resources Control Board's latest list of systems available to the public (See Attachment C for the full list). Trash capture treatment flowrate calculation is also provided in Attachment C.

GIS Coordinate: 33.681095 Lat./-117.889922 Long.

IV.3.5 Hydromodification Control BMPs

Describe hydromodification control BMPs. *See Section 5 of the Technical Guidance Document (TGD).* Include sections for selection, suitability, sizing, and infeasibility, as applicable. Detail compliance with Prior Conditions of Approval (if applicable).

Hydromodification Control BMPs	
BMP Name	BMP Description
N/A	N/A

IV.3.6 Regional/Sub-Regional LID BMPs

Describe regional/sub-regional LID BMPs in which the project will participate. *Refer to Section 7.II-2.4.3.2 of the Model WQMP.*

Regional/Sub-Regional LID BMPs
N/A

IV.3.7 Treatment Control BMPs

Treatment control BMPs can only be considered if the project conformance analysis indicates that it is not feasible to retain the full design capture volume with LID BMPs. Describe treatment control BMPs including sections for selection, sizing, and infeasibility, as applicable.

Treatment Control BMPs	
BMP Name	BMP Description
N/A	N/A

IV.3.8 Non-structural Source Control BMPs

Fill out non-structural source control check box forms or provide a brief narrative explaining if non-structural source controls were not used.

Non-Structural Source Control BMPs				
Identifier	Name	Check One		If not applicable, state brief reason
		Included	Not Applicable	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	There is no industrial activity is proposed on site.
N6	Local Industrial Permit Compliance	☐	☒	Project does not discharge any fuel and other areas of concern to public properties
N7	Spill Contingency Plan	☐	☒	No hazardous material is proposed on site.
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tank is proposed on site.
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous material is proposed on site.
N10	Uniform Fire Code Implementation	☒	☐	
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	No Loading Docks are proposed on site.
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	No gas outlets are proposed on site.

IV.3.9 Structural Source Control BMPs

Fill out structural source control check box forms or provide a brief narrative explaining if structural source controls were not used.

Structural Source Control BMPs				
Identifier	Name	Check One		If not applicable, state brief reason
		Included	Not Applicable	
S1	Provide storm drain system stenciling and signage	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	No outdoor material storage areas are proposed on site.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☒	☐	
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☐	☒	No large slopes or natural channels are proposed on site.
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☐	☐	N/A
S6	Dock areas	☐	☒	No areas are proposed onsite.
S7	Maintenance bays	☐	☒	No areas are proposed onsite.
S8	Vehicle wash areas	☐	☒	No areas are proposed onsite.
S9	Outdoor processing areas	☐	☒	No areas are proposed onsite.
S10	Equipment wash areas	☐	☒	No areas are proposed onsite.
S11	Fueling areas	☐	☒	No areas are proposed onsite.
S12	Hillside landscaping	☐	☒	No areas are proposed onsite.
S13	Wash water control for food preparation areas	☐	☒	No areas are proposed onsite.
S14	Community car wash racks	☐	☒	No areas are proposed onsite.

IV.4 Alternative Compliance Plan (If Applicable)

Not applicable.

IV.4.1 Water Quality Credits

Determine if water quality credits are applicable for the project. *Refer to Section 3.1 of the Model WQMP for description of credits and Appendix VI of the Technical Guidance Document (TGD) for calculation methods for applying water quality credits.*

Description of Proposed Project				
Project Types that Qualify for Water Quality Credits (Select all that apply):				
☐ Redevelopment projects that reduce the overall impervious footprint of the project site.	☐ Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants or contaminants, and which have the potential to contribute to adverse ground or surface WQ if not redeveloped.		☐ Higher density development projects which include two distinct categories (credits can only be taken for one category): those with more than seven units per acre of development (lower credit allowance); vertical density developments, for example, those with a Floor to Area Ratio (FAR) of 2 or those having more than 18 units per acre (greater credit allowance).	
☐ Mixed use development, such as a combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that can demonstrate environmental benefits that would not be realized through single use projects (e.g. reduced vehicle trip traffic with the potential to reduce sources of water or air pollution).		☐ Transit-oriented developments, such as a mixed use residential or commercial area designed to maximize access to public transportation; similar to above criterion, but where the development center is within one half mile of a mass transit center (e.g. bus, rail, light rail or commuter train station). Such projects would not be able to take credit for both categories, but may have greater credit assigned		☐ Redevelopment projects in an established historic district, historic preservation area, or similar significant city area including core City Center areas (to be defined through mapping).
☐ Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses.	☐ Developments in a city center area.	☐ Developments in historic districts or historic preservation areas.	☐ Live-work developments, a variety of developments designed to support residential and vocational needs together – similar to criteria to mixed use development; would not be able to take credit for both categories.	☐ In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas.

Calculation of Water Quality Credits (if applicable)	The entire DVC for the project is being treated by a LID BMP. Water Quality credits will not be used.
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IV.4.2 Alternative Compliance Plan Information

Describe an alternative compliance plan (if applicable). Include alternative compliance obligations (i.e., gallons, pounds) and describe proposed alternative compliance measures. *Refer to Section 7.II 3.0 in the Model WQMP.*

N/A

Section V Inspection/Maintenance Responsibility for BMPs

Fill out information in table below. Prepare and attach an Operation and Maintenance Plan. Identify the funding mechanism through which BMPs will be maintained. Inspection and maintenance records must be kept for a minimum of five years for inspection by the regulatory agencies. *Refer to Section 7.II 4.0 in the Model WQMP.*

BMP Inspection/Maintenance			
BMP	Reponsible Party(s)	Inspection/Maintenance Activities Required	Minimum Frequency of Activities
N1 Education for Property Owners, Tenants and Occupants N12 Employee Training	City of Costa Mesa	Owner will ensure that all employees and contractors will be given a copy of the educational materials and activity restrictions. Brochures can be downloaded from www.ocwatersheds.com and are attached as Attachment E on the project-specific WQMP.	Educational materials will be provided to employees and contractors at hire and annually, thereafter
N2 Activity Restrictions	City of Costa Mesa	The restricted activities include, but not limited to the following: car washing, cleaning trash cans with water, use of chemical/additives when washing concrete sidewalks.	Continuous
N3 Common Area Landscape Management	City of Costa Mesa	All landscape maintenance activities will conform to the Orange County Management Guidelines for the use of fertilizers and pesticides.	Weekly

Priority Project Water Quality Management Plan (WQMP)
Costa Mesa Fire Station 2

N4 BMP Maintenance	City of Costa Mesa	Maintain all applicable BMPs per this O&M Plan.	Continuous
N10 Uniform Fire Code Implementation	City of Costa Mesa	Comply with Article 80 of the Uniform Fire Code.	Continuous
N11 Common Area Litter Control	City of Costa Mesa	Weekly sweeping and trash pickup as necessary within all project areas.	Daily inspection and daily clean up and as needed
N14 Common Area Catch Basin Inspection	City of Costa Mesa	Remove trash and debris from catch basins and grates. Check for damage, clogging, and standing water. Repair or mitigate clogging/standing water, as needed.	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events >0.5 inches
N15 Street Sweeping Private Streets and Parking Lots	City of Costa Mesa	Monthly sweeping/vacuuming of paved areas	Monthly
S1 Storm Drain Stenciling and Signage	City of Costa Mesa	Check that all catch basins in paved areas marked or stenciled with "No dumping-Drains to Ocean" language. Replace/repaint markings if faded, damaged, removed, or otherwise illegible.	Annually

Priority Project Water Quality Management Plan (WQMP)
Costa Mesa Fire Station 2

Modular Wetlands System (MWS)	City of Costa Mesa hired contractor	• Remove debris and trash – every 6 months • Replace cartridge filter media – every 12 months • Replace drain down filter media – every 12 months - Trim Vegetation – every 6 months	Per manufacturer's recommendations
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Section VI BMP Exhibit (Site Plan)

VI.1 BMP Exhibit (Site Plan)

See WQMP Site Plan in Attachment A.

VI.2 Submittal and Recordation of Water Quality Management Plan

Following approval of the Final Project-Specific WQMP, three copies of the approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be submitted. In addition, these documents shall be submitted in a PDF format.

Each approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be recorded in the Orange County Clerk-Recorder's Office, prior to close-out of grading and/or building permit. Educational Materials are not required to be included.

Section VII Educational Materials

Refer to the Orange County Stormwater Program (ocwatersheds.com) for a library of materials available. Please only attach the educational materials specifically applicable to this project. Other materials specific to the project may be included as well and must be attached.

Education Materials			
Residential Material (http://www.ocwatersheds.com)	Check If Applicable	Business Material (http://www.ocwatersheds.com)	Check If Applicable
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☐	Tips for Using Concrete and Mortar	☒
Tips for the Home Mechanic	☐	Tips for the Food Service Industry	☐
Homeowners Guide for Sustainable Water Use	☐	Proper Maintenance Practices for Your Business	☒
Household Tips	☐	Other Material	Check If Attached
Proper Disposal of Household Hazardous Waste	☐		
Recycle at Your Local Used Oil Collection Center (North County)	☐		☐
Recycle at Your Local Used Oil Collection Center (Central County)	☐		☐
Recycle at Your Local Used Oil Collection Center (South County)	☐		☐
Tips for Maintaining a Septic Tank System	☐		☐
Responsible Pest Control	☒		☐
Sewer Spill	☐		☐
Tips for the Home Improvement Projects	☐		☐
Tips for Horse Care	☐		☐
Tips for Landscaping and Gardening	☒		☐
Tips for Pet Care	☐		☐
Tips for Pool Maintenance	☐		☐
Tips for Residential Pool, Landscape and Hardscape Drains	☐		☐
Tips for Projects Using Paint	☐		☐



Support from Orange County residents and businesses is needed to improve water quality and reduce urban runoff pollution. Proper use and disposal of materials will help stop pollution before it reaches the storm drain and the ocean.

Non-point source pollution can have a serious impact on water quality in Orange County. Pollutants from the storm drain system can harm marine life as well as coastal and wetland habitats. They can also degrade recreation areas such as beaches, harbors and bays.

Stormwater quality management programs have been developed throughout Orange County to educate and encourage the public to protect water quality, monitor runoff in the storm drain system, investigate illegal dumping and maintain storm drains.



The Effect on the Ocean

Dumping one quart of motor oil into a storm drain can contaminate 250,000 gallons of water.

For More Information

- California Environmental Protection Agency**
www.calepa.ca.gov
- Air Resources Board**
www.arb.ca.gov
 - Department of Pesticide Regulation**
www.cdpr.ca.gov
 - Department of Toxic Substances Control**
www.dtsc.ca.gov
 - Integrated Waste Management Board**
www.ciwmb.ca.gov
 - Office of Environmental Health Hazard Assessment**
www.oehha.ca.gov
 - State Water Resources Control Board**
www.waterboards.ca.gov

Earth 911 - Community-Specific Environmental Information 1-800-cleanup or visit www.1800cleanup.org

Health Care Agency’s Ocean and Bay Water Closure and Posting Hotline
(714) 433-6400 or visit www.ocbeachinfo.com

Integrated Waste Management Dept. of Orange County (714) 834-6752 or visit www.oclandfills.com for information on household hazardous waste collection centers, recycling centers and solid waste collection

O.C. Agriculture Commissioner
(714) 447-7100 or visit www.ocagcomm.com

Stormwater Best Management Practice Handbook
Visit www.cabmphandbooks.com

UC Master Gardener Hotline
(714) 708-1646 or visit www.uccemg.com

The Orange County Stormwater Program has created and moderates an electronic mailing list to facilitate communications, take questions and exchange ideas among its users about issues and topics related to stormwater and urban runoff and the implementation of program elements. To join the list, please send an email to ocstormwaterinfo-join@list.ocwatersheds.com



- Automotive leaks and spills.
- Improper disposal of used oil and other engine fluids.
- Metals found in vehicle exhaust, weathered paint, rust, metal plating and tires.
- Pesticides and fertilizers from lawns, gardens and farms.
- Improper disposal of cleaners, paint and paint removers.
- Soil erosion and dust debris from landscape and construction activities.
- Litter, lawn clippings, animal waste, and other organic matter.
- Oil stains on parking lots and paved surfaces.

Sources of Non-Point Source Pollution

Aliso Viejo.	(949)	425-2535
Anaheim Public Works Operations	(714)	765-6860
Brea Engineering.	(714)	990-7666
Buena Park Public Works	(714)	562-3655
Costa Mesa Public Services.	(714)	754-5323
Cypress Public Works.	(714)	229-6740
Dana Point Public Works.	(949)	248-3584
Fountain Valley Public Works	(714)	593-4441
Fullerton Engineering Dept..	(714)	738-6853
Garden Grove Public Works	(714)	741-5956
Huntington Beach Public Works	(714)	536-5431
Irvine Public Works.	(949)	724-6315
La Habra Public Services.	(562)	905-9792
La Palma Public Works.	(714)	690-3310
Laguna Beach Water Quality.	(949)	497-0378
Laguna Hills Public Services.	(949)	707-2650
Laguna Niguel Public Works	(949)	362-4337
Laguna Woods Public Works.	(949)	639-0500
Lake Forest Public Works	(949)	461-3480
Los Alamitos Community Dev..	(562)	431-3538
Mission Viejo Public Works	(949)	470-3056
Newport Beach, Code & Water Quality Enforcement	(949)	644-3215
Orange Public Works.	(714)	532-6480
Placentia Public Works	(714)	993-8245
Rancho Santa Margarita	(949)	635-1800
San Clemente Environmental Programs	(949)	361-6143
San Juan Capistrano Engineering	(949)	234-4413
Santa Ana Public Works	(714)	647-3380
Seal Beach Engineering	(562)	431-2527 x317
Stanton Public Works.	(714)	379-9222 x204
Tustin Public Works/Engineering	(714)	573-3150
Villa Park Engineering	(714)	998-1500
Westminster Public Works/Engineering	(714)	898-3311 x446
Yorba Linda Engineering	(714)	961-7138
Orange County Stormwater Program	(877)	897-7455
Orange County 24-Hour Water Pollution Problem Reporting Hotline 1-877-89-SPILL (1-877-897-7455)		

On-line Water Pollution Problem Reporting Form
www.ocwatersheds.com



Printed on Recycled Paper



- Anything we use outside homes, vehicles and businesses – like motor oil, paint, pesticides, fertilizers and cleaners – can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer systems; unlike water in sanitary sewers (from sinks or toilets), water in storm drains is not treated before entering our waterways.

Where Does It Go?

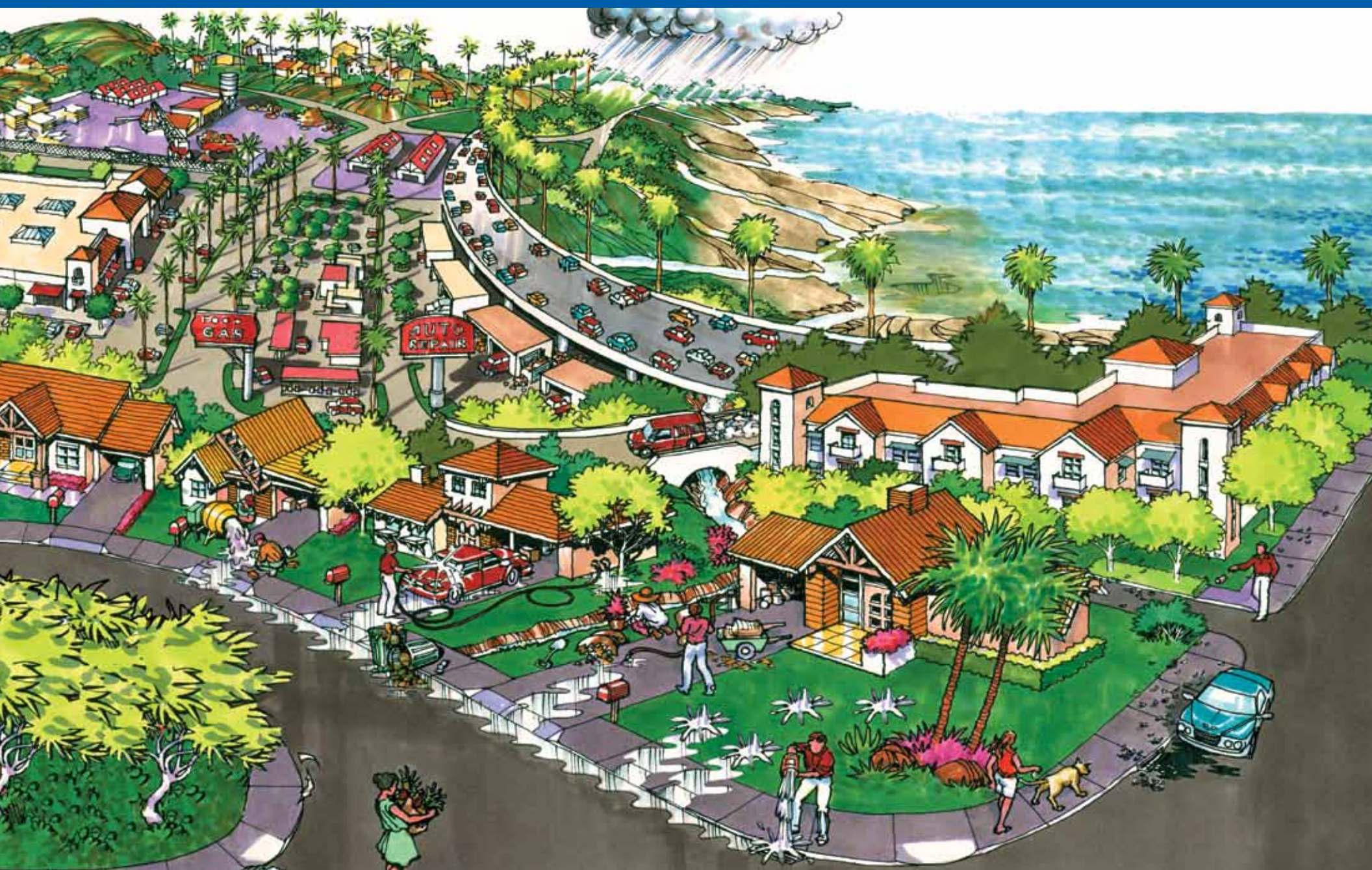
- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution is sometimes called “non-point source” pollution.
- There are two types of non-point source pollution: stormwater and urban runoff.
- Stormwater runoff results from rainfall. When rainstorms cause large volumes of water to rinse the urban landscape, picking up pollutants along the way.
- Urban runoff can happen any time of the year when excessive water use from irrigation, vehicle washing and other sources carries trash, lawn clippings and other urban pollutants into storm drains.

Did You Know?

Even if you live miles from the Pacific Ocean, you may be unknowingly polluting it.

The Ocean Begins at Your Front Door

The Ocean Begins at Your Front Door



Never allow pollutants to enter the street, gutter or storm drain!

Follow these simple steps to help reduce water pollution:

Household Activities

- Do not rinse spills with water. Use dry cleanup methods such as applying cat litter or another absorbent material, sweep and dispose of in the trash. Take items such as used or excess batteries, oven cleaners, automotive fluids, painting products and cathode ray tubes, like TVs and computer monitors, to a Household Hazardous Waste Collection Center (HHWCC).
- For a HHWCC near you call (714) 834-6752 or visit www.oilandfills.com.
- Do not hose down your driveway, sidewalk or patio to the street, gutter or storm drain. Sweep up debris and dispose of it in the trash.

Automotive

- Take your vehicle to a commercial car wash whenever possible. If you wash your vehicle at home, choose soaps, cleaners, or detergents labeled non-toxic, phosphate-free or biodegradable. Vegetable and citrus-based products are typically safest for the environment.
- Do not allow washwater from vehicle washing to drain into the street, gutter or storm drain. Excess washwater should be disposed of in the sanitary sewer (through a sink or toilet) or onto an absorbent surface like your lawn.
- Monitor your vehicles for leaks and place a pan under leaks. Keep your vehicles well maintained to stop and prevent leaks.
- Never pour oil or antifreeze in the street, gutter or storm drain. Recycle these substances at a service station, a waste oil collection center or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.1800cleanup.org.

Pool Maintenance

- Pool and spa water must be dechlorinated and free of excess acid, alkali or color to be allowed in the street, gutter or storm drain.
- When it is not raining, drain dechlorinated pool and spa water directly into the sanitary sewer.
- Some cities may have ordinances that do not allow pool water to be disposed of in the storm drain. Check with your city.

Landscape and Gardening

- Do not over-water. Water your lawn and garden by hand to control the amount of water you use or set irrigation systems to reflect seasonal water needs. If water flows off your yard onto your driveway or sidewalk, your system is over-watering. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of waste by composting, hauling it to a permitted landfill, or as green waste through your city's recycling program.
- Follow directions on pesticides and fertilizer, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Take unwanted pesticides to a HHWCC to be recycled. For locations and hours of HHWCC, call (714) 834-6752 or visit www.oilandfills.com.

Trash

- Place trash and litter that cannot be recycled in securely covered trash cans.
- Whenever possible, buy recycled products.
- Remember: Reduce, Reuse, Recycle.

Pet Care

- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash. Pet waste, if left outdoors, can wash into the street, gutter or storm drain.
- If possible, bathe your pets indoors. If you must bathe your pet outside, wash it on your lawn or another absorbent/permeable surface to keep the washwater from entering the street, gutter or storm drain.
- Follow directions for use of pet care products and dispose of any unused products at a HHWCC.

Common Pollutants

Home Maintenance

- Detergents, cleaners and solvents
- Oil and latex paint
- Swimming pool chemicals
- Outdoor trash and litter

Lawn and Garden

- Pet and animal waste
- Pesticides
- Clippings, leaves and soil
- Fertilizer

Automobile

- Oil and grease
- Radiator fluids and antifreeze
- Cleaning chemicals
- Brake pad dust



Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Materials and excess concrete or mortar can be blown or washed into the storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never throw building materials into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com.

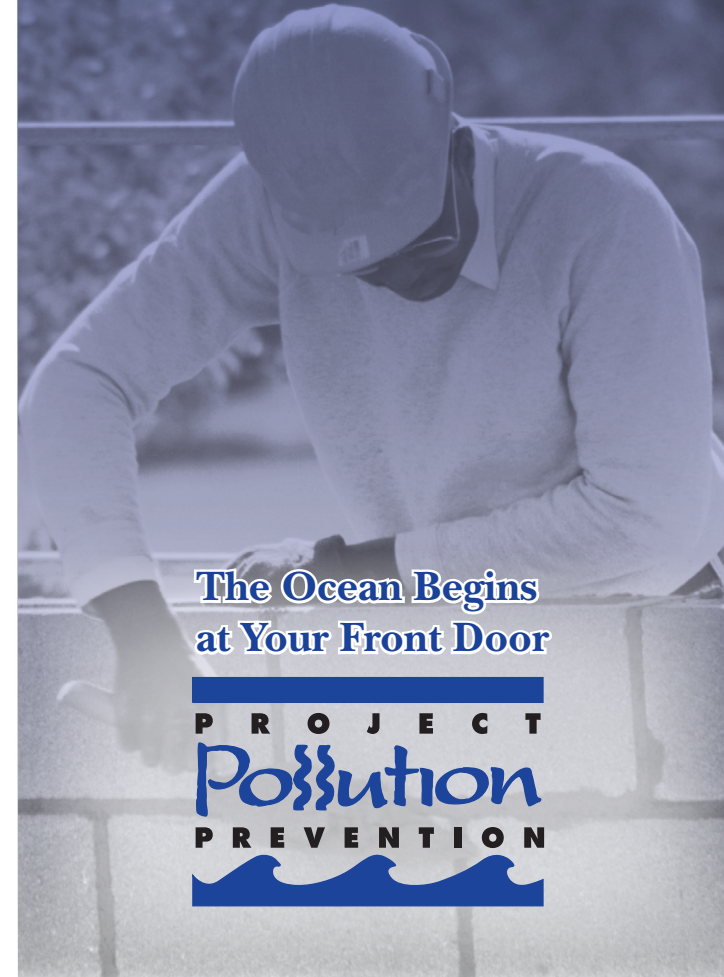
To report a spill,
call the
**Orange County 24-Hour
Water Pollution Reporting Hotline**
at **1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

The Tips contained in this brochure provide useful information about how you can keep materials and washwater from entering the storm drain system. If you have other suggestions for how water and materials may be contained, please contact your city's stormwater representative or call the Orange County Stormwater Program.



Tips for Using Concrete and Mortar



**The Ocean Begins
at Your Front Door**

P R O J E C T
Pollution
P R E V E N T I O N

Tips for Using Concrete and Mortar

Never allow materials or washwater to enter the street or storm drain.

Before the Project

- Schedule projects for dry weather.
- Store materials under cover, with temporary roofs or plastic sheets, to eliminate or reduce the possibility that the materials can be carried from the project site to streets, storm drains or adjacent properties via rainfall, runoff or wind.
- Minimize waste by ordering only the amount of materials needed to complete the job.
- Take measures to block nearby storm drain inlets.

During the Project

- Set up and operate small mixers on tarps or heavy drop cloths.
- Do not mix more fresh concrete or cement than is needed for the job.



- When breaking up pavement, pick up all chunks and pieces and recycle them at a local construction and demolition recycling company. (See information to the right)
- When making saw cuts in pavement, protect nearby storm drain inlets during the saw-cutting operation and contain the slurry. Collect the slurry residue from the pavement or gutter and remove from the site.



Clean-Up

- Dispose of small amounts of dry concrete, grout or mortar in the trash.
- Never hose materials from exposed aggregate concrete, asphalt or similar treatments into a street, gutter, parking lot, or storm drain.
- Wash concrete mixers and equipment in designated washout areas where the water can flow into a containment area or onto dirt. Small amounts of dried material can be disposed of in the trash. Large amounts



should be recycled at a local construction and demolition recycling company. (See information below)

- Recycle cement wash water by pumping it back into cement mixers for reuse.

Spills

- Never hose down pavement or impermeable surfaces where fluids have spilled. Use an absorbent material such as cat litter to soak up a spill, then sweep and dispose in the trash.
- Clean spills on dirt areas by digging up and properly disposing of contaminated dry soil in trash.
- Immediately report significant spills to the County's 24-Hour Water Pollution Problem Reporting Hotline at 714-567-6363 or log onto the County's website at www.ocwatersheds.com and fill out an incident reporting form.

For a list of construction and demolition recycling locations in your area visit www.ciwmb.ca.gov/Recycle/.

For additional information on how to control, prevent, remove, and reduce pollution refer to the Stormwater Best Management Practice Handbook, available on-line at www.cabmphandbooks.com.

***Preventing water
pollution at your
commercial/industrial site***

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many landscape and building maintenance activities can lead to water pollution if you're not careful. Paint, chemicals, plant clippings and other materials can be blown or washed into storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour soap or fertilizers into the ocean, so why would you let them enter the storm drains? Follow these easy tips to help prevent water pollution.

Some types of industrial facilities are required to obtain coverage under the State General Industrial Permit. For more information visit: www.swrcb.ca.gov/stormwater/industrial.html



For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

To report a spill,
call the
**Orange County 24-Hour
Water Pollution Problem
Reporting Hotline**
at **1-877-89-SPILL** (1-877-897-7455).

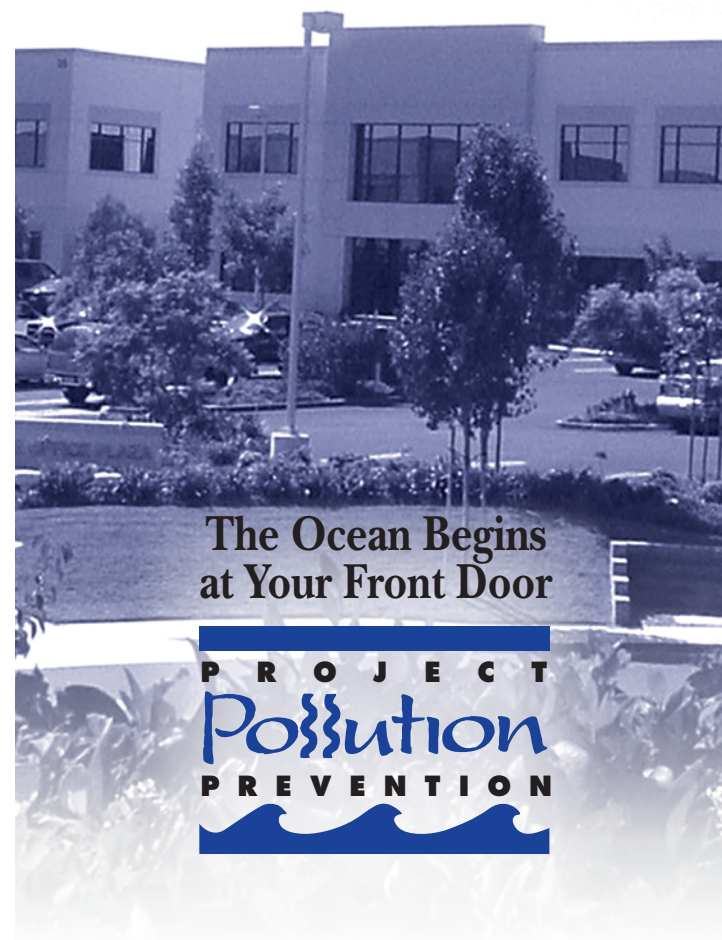
For emergencies, dial 911.



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Help Prevent Ocean Pollution:

**Proper Maintenance
Practices for
Your Business**



**The Ocean Begins
at Your Front Door**



Proper Maintenance Practices for your Business

Landscape Maintenance

- Compost grass clippings, leaves, sticks and other vegetation, or dispose of it at a permitted landfill or in green waste containers. Do not dispose of these materials in the street, gutter or storm drain.
- Irrigate slowly and inspect the system for leaks, overspraying and runoff. Adjust automatic timers to avoid overwatering.
- Follow label directions for the use and disposal of fertilizers and pesticides.
- Do not apply pesticides or fertilizers if rain is expected within 48 hours or if wind speeds are above 5 mph.
- Do not spray pesticides within 100 feet of waterways.
- Fertilizers should be worked into the soil rather than dumped onto the surface.
- If fertilizer is spilled on the pavement or sidewalk, sweep it up immediately and place it back in the container.

Building Maintenance

- Never allow washwater, sweepings or sediment to enter the storm drain.
- Sweep up dry spills and use cat litter, towels or similar materials to absorb wet spills. Dispose of it in the trash.
- If you wash your building, sidewalk or parking lot, you **must** contain the water. Use a shop vac to collect the water and contact your city or sanitation agency for proper disposal information. Do not let water enter the street, gutter or storm drain.
- Use drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of materials in the trash.
- Use a ground cloth or oversized tub for mixing paint and cleaning tools.
- Use a damp mop or broom to clean floors.
- Cover dumpsters to keep insects, animals, rainwater and sand from entering. Keep the area around the dumpster clear of trash and debris. Do not overfill the dumpster.

- Call your trash hauler to replace leaking dumpsters.
- Do not dump any toxic substance or liquid waste on the pavement, the ground, or near a storm drain. Even materials that seem harmless such as latex paint or biodegradable cleaners can damage the environment.
- Recycle paints, solvents and other materials. For more information about recycling and collection centers, visit www.oclandfills.com.
- Store materials indoors or under cover and away from storm drains.
- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry, carpet, plastic, pipes, drywall, rocks, dirt, and green waste. For a listing of construction and demolition recycling locations in your area, visit www.ciwmb.ca.gov/recycle.
- Properly label materials. Familiarize employees with Material Safety Data Sheets.

NEVER DISPOSE
OF ANYTHING
IN THE STORM
DRAIN.



Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as pest control can lead to water pollution if you're not careful. Pesticide treatments must be planned and applied properly to ensure that pesticides do not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump pesticides into the ocean, so don't let it enter the storm drains. Pesticides can cause significant damage to our environment if used improperly. If you are thinking of using a pesticide to control a pest, there are some important things to consider.

For more information,
please call
University of California Cooperative
Extension Master Gardeners at
(714) 708-1646
or visit these Web sites:
www.uccemg.org
www.ipm.ucdavis.edu

For instructions on collecting a specimen
sample visit the Orange County
Agriculture Commissioner's website at:
http://www.ocagcomm.com/ser_lab.asp

To report a spill, call the
**Orange County 24-Hour
Water Pollution Problem
Reporting Hotline**
at 1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

Information From:
Cheryl Wilen, Area IPM Advisor; Darren Haver,
Watershed Management Advisor; Mary
Louise Flint, IPM Education and Publication
Director; Pamela M. Geisel, Environmental
Horticulture Advisor; Carolyn L. Unruh,
University of California Cooperative
Extension staff writer. Photos courtesy of
the UC Statewide IPM Program and
Darren Haver.

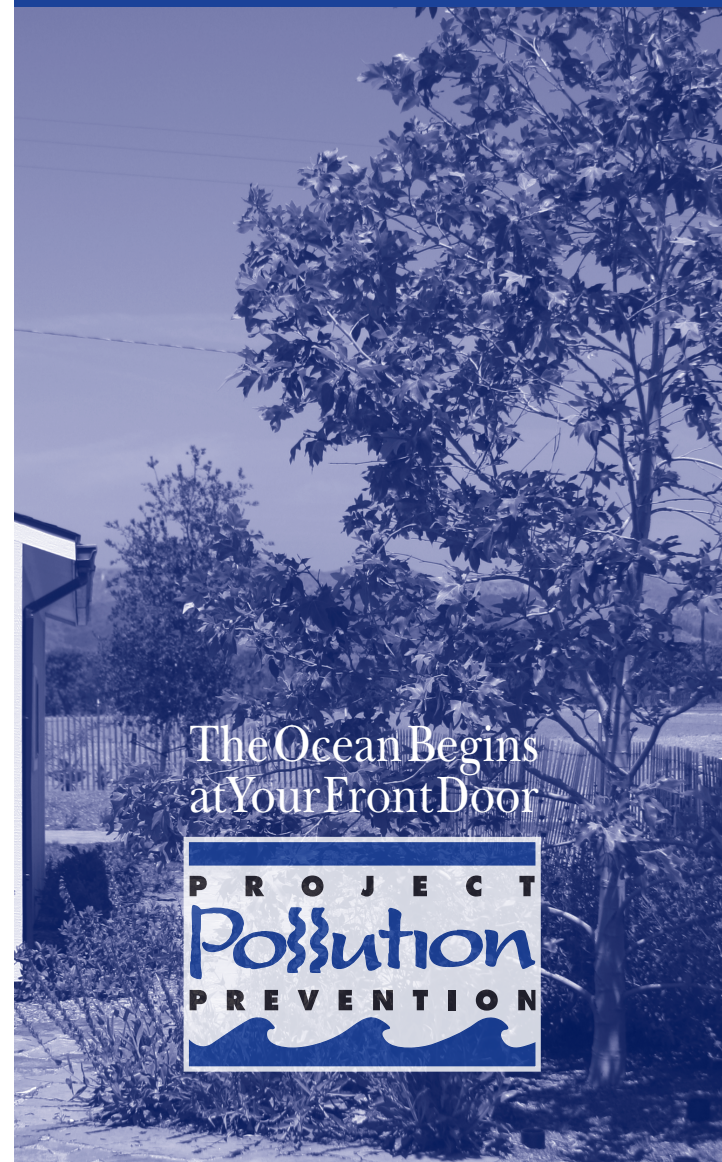
Funding for this brochure has been provided in full
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Resources Control Board (SWRCB) pursuant to the
Costa-Machado Water Act of 2000 (Prop. 13).



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Help Prevent Ocean Pollution:

Responsible Pest Control



The Ocean Begins
at Your Front Door



Tips for Pest Control

Key Steps to Follow:

Step 1: Correctly identify the pest (insect, weed, rodent, or disease) and verify that it is actually causing the problem.



This is important because beneficial insects are often mistaken for pests and sprayed with pesticides needlessly.

Consult with a Certified Nursery

Professional at a local nursery or garden center or send a sample of the pest to the Orange County Agricultural Commissioner's Office.

Determine if the pest is still present – even though you see damage, the pest may have left.

Step 2: Determine how many pests are present and causing damage.



Small pest populations may be controlled more safely using non-pesticide techniques. These include removing food sources, washing off leaves with a strong stream of water, blocking entry into the home using caulking and replacing problem plants with ones less susceptible to pests.

Integrated Pest Management (IPM) usually combines several least toxic pest control methods for long-term prevention and management of pest problems without harming you, your family, or the environment.



Step 3: If a pesticide must be used, choose the least toxic chemical.

Obtain information on the least toxic pesticides that are effective at controlling the target pest from the UC Statewide Integrated Pest Management (IPM) Program's Web site at www.ipm.ucdavis.edu.

Seek out the assistance of a Certified Nursery Professional at a local nursery or garden center when selecting a pesticide. Purchase the smallest amount of pesticide available.

Apply the pesticide to the pest during its most vulnerable life stage. This information can be found on the pesticide label.

Step 4: Wear appropriate protective clothing.

Follow pesticide labels regarding specific types of protective equipment you should wear. Protective clothing should always be washed separately from other clothing.

Step 5: Continuously monitor external conditions when applying pesticides such as weather, irrigation, and the presence of children and animals.

Never apply pesticides when rain is predicted within the next 48 hours. Also, do not water after applying pesticides unless the directions say it is necessary.

Apply pesticides when the air is still; breezy conditions may cause the spray or dust to drift away from your targeted area.

In case of an emergency call 911 and/or the regional poison control number at (714) 634-5988 or (800) 544-4404 (CA only).

For general questions you may also visit www.calpoison.org.

Step 6: In the event of accidental spills, sweep up or use an absorbent agent to remove any excess pesticides. Avoid the use of water.

Be prepared. Have a broom, dust pan, or dry absorbent material, such as cat litter, newspapers or paper towels, ready to assist in cleaning up spills.

Contain and clean up the spill right away. Place contaminated materials in a doubled plastic bag. All materials used to clean up the spill should be properly disposed of according to your local Household Hazardous Waste Disposal site.

Step 7: Properly store and dispose of unused pesticides.

Purchase Ready-To-Use (RTU) products to avoid storing large concentrated quantities of pesticides.



Store unused chemicals in a locked cabinet.

Unused pesticide chemicals may be disposed of at a Household Hazardous Waste Collection Center.

Empty pesticide containers should be triple rinsed prior to disposing of them in the trash.

Household Hazardous Waste
Collection Center
(714) 834-6752
www.oilandfills.com





Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Fertilizers, pesticides and other chemicals that are left on yards or driveways can be blown or washed into storm drains that flow to the ocean. Overwatering lawns can also send materials into storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour gardening products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

UCCE Master Gardener Hotline:
(714) 708-1646

To report a spill,
call the
**Orange County 24-Hour
Water Pollution Problem
Reporting Hotline**
1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

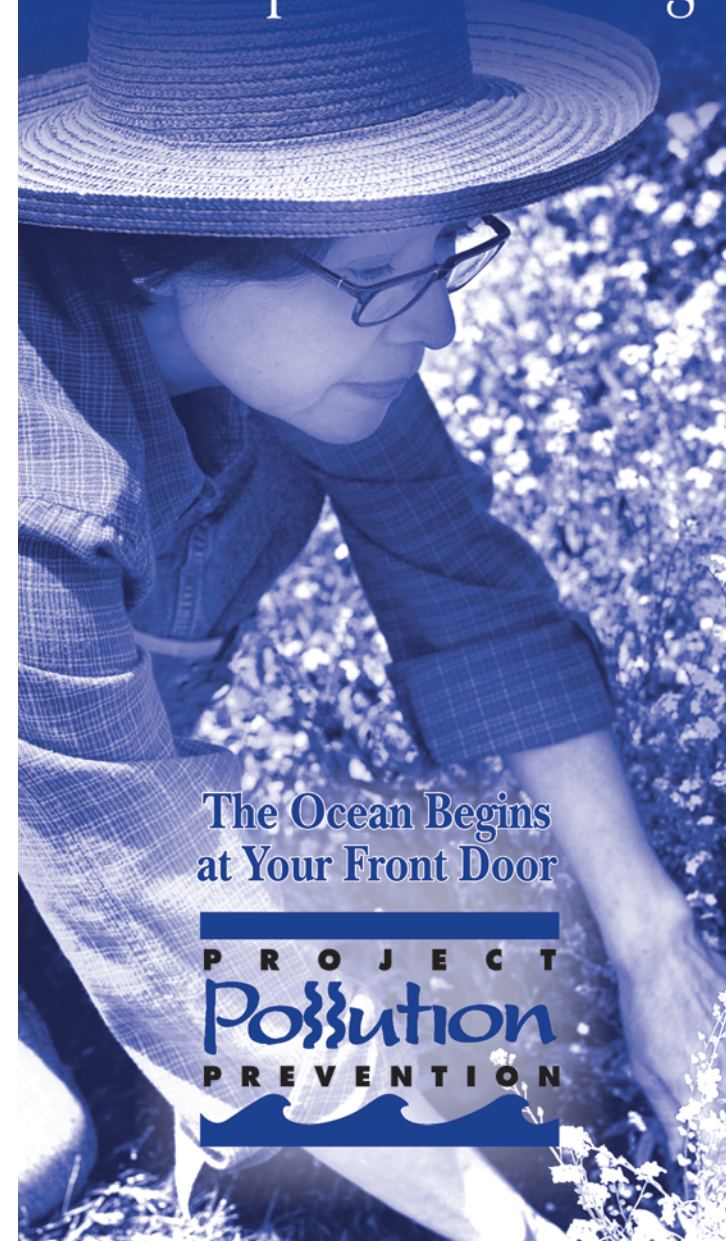
The tips contained in this brochure provide useful information to help prevent water pollution while landscaping or gardening. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.



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Help Prevent Ocean Pollution:

Tips for Landscape & Gardening



The Ocean Begins
at Your Front Door



Tips for Landscape & Gardening

Never allow gardening products or polluted water to enter the street, gutter or storm drain.

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.
- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.
- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.



Garden & Lawn Maintenance

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro spray systems. Periodically inspect and fix leaks and misdirected sprinklers.

- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.



- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.



- Rinse empty pesticide containers and re-use rinse water as you would use the

product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.

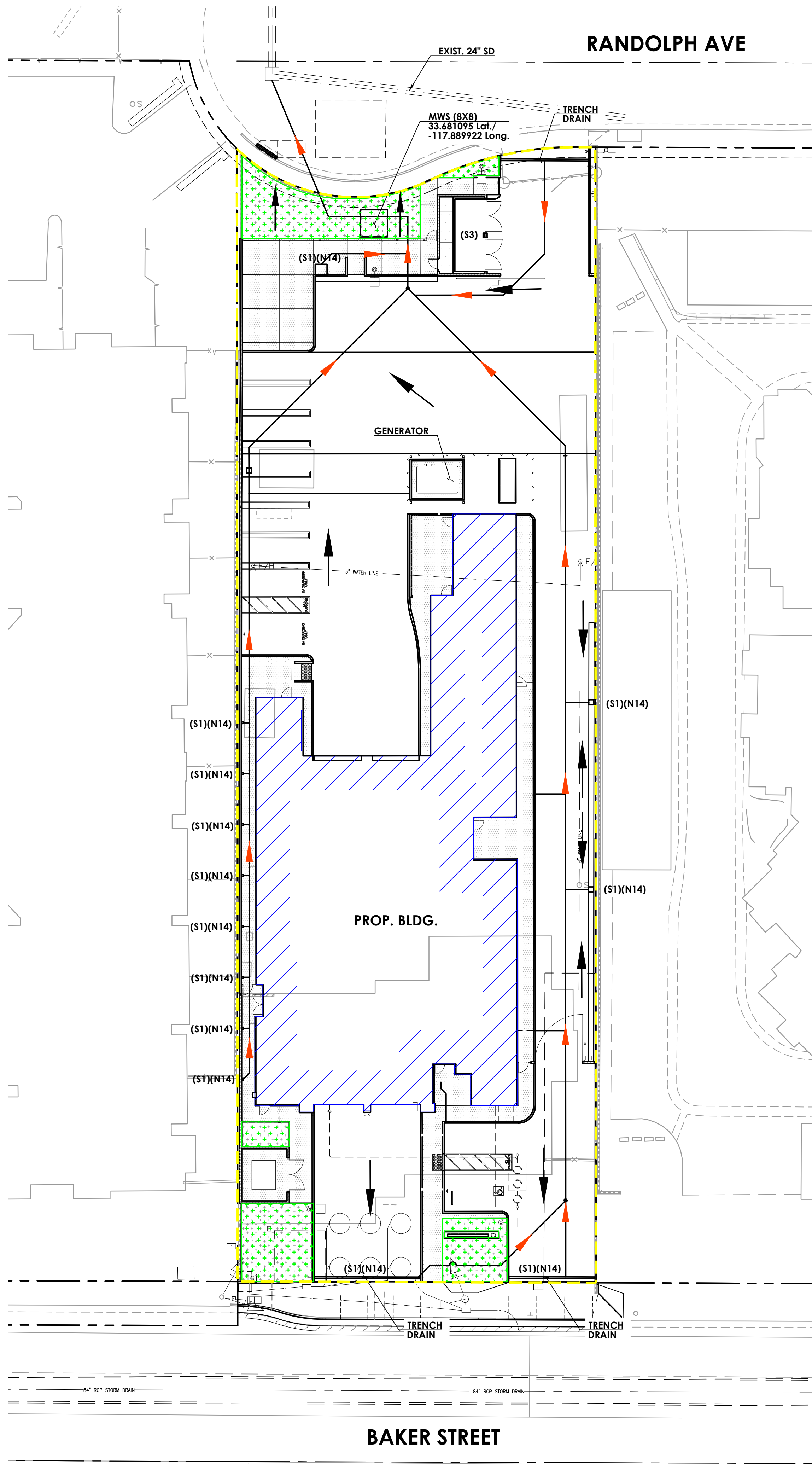
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit www.ipm.ucdavis.edu.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

Household Hazardous Waste Collection Centers

Anaheim:	1071 N. Blue Gum St.
Huntington Beach:	17121 Nichols St.
Irvine:	6411 Oak Canyon
San Juan Capistrano:	32250 La Pata Ave.

For more information, call (714) 834-6752 or visit www.oclandfills.com

ATTACHMENT A – SITE PLAN

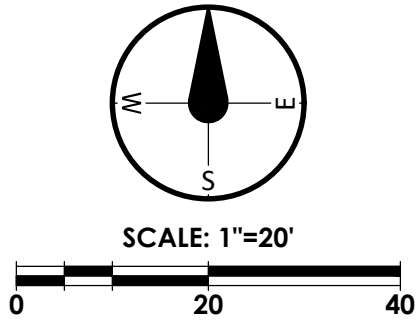


- LEGEND**
- STORM DRAIN FLOW DIRECTION
 - SURFACE FLOW DIRECTION
 - LIMIT OF WORK/DMA BOUNDARY
 - PROP. BLDG.
 - LANDSCAPE AREAS (S4)

- SOURCE CONTROL BMP LEGEND**
- Structural BMPs**
- (S1) Storm Drain Stenciling and Signage
 - (S3) Trash Enclosure
 - (S4) Efficient Irrigation
- Non-Structural BMPs**
- (N1) Education for Property Owners and Occupants
 - (N2) Activity Restrictions
 - (N3) Common Area Landscape Management
 - (N4) BMP Maintenance
 - (N10) Uniform Fire Code Implementation
 - (N11) Common Area Litter Control
 - (N12) Employee Training
 - (N14) Common Area Catch Basin Inspection
 - (N15) Street Sweeping Private Streets and Parking Lots

BMP'S FOR ENTIRE SITE:
(N1) (N2) (N3) (N4) (N10)
(N11) (N12) (N15)

BMP SUMMARY TABLE							
DMA	TOTAL AREA	PERVIOUS AREA	IMPERVIOUS AREA	TREATMENT FLOWRATE	LID BMP	TREATMENT CAPACITY	GIS COORDINATE
A	34,520	1,810	32,710	0.1770	MWS L-8-8-V	0.2310	33.681095 LAT./-117.889922 LONG.



**COSTA MESA
FIRE STATION NO. 2**

COSTA MESA FIRE & RESCUE DEPARTMENT
800 BAKER STREET
COSTA MESA, CA 92626



CONSULTANT

civTEC CIVIL
ENGINEERING
CONSULTING

999 CORPORATE DR., SUITE 100
LADERA RANCH, CA 92694
p: 949.463.8822
e: tec@civtec.net

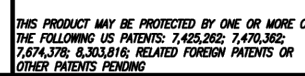
NO	DATE	BY	DESCRIPTION
#			REVISIONS

DRAWN: STAFF CHECKED: TEC
DATE: 3/30/2026 SCALE: PER PLAN
PROJECT NUMBER: 170.01

WQMP SITE MAP

DRAWING
NUMBER: **WQ-1**

INSTALLATION NOTES



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**STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL**

civTEC CIVIL
ENGINEERING
CONSULTING
999 CORPORATE DR., SUITE 100
LADERA RANCH, CA 92694
p: 949.463.8822
e: tec@civtec.net

DRAWN: STAFF	CHECKED: TEC
DATE: 6/9/2026	SCALE: PER PLAN
PROJECT NUMBER: 170.01	

DRAWING NUMBER: **WQ-2**

ATTACHMENT B – SIMPLE DESIGN CAPTURE VOLUME SIZING METHOD

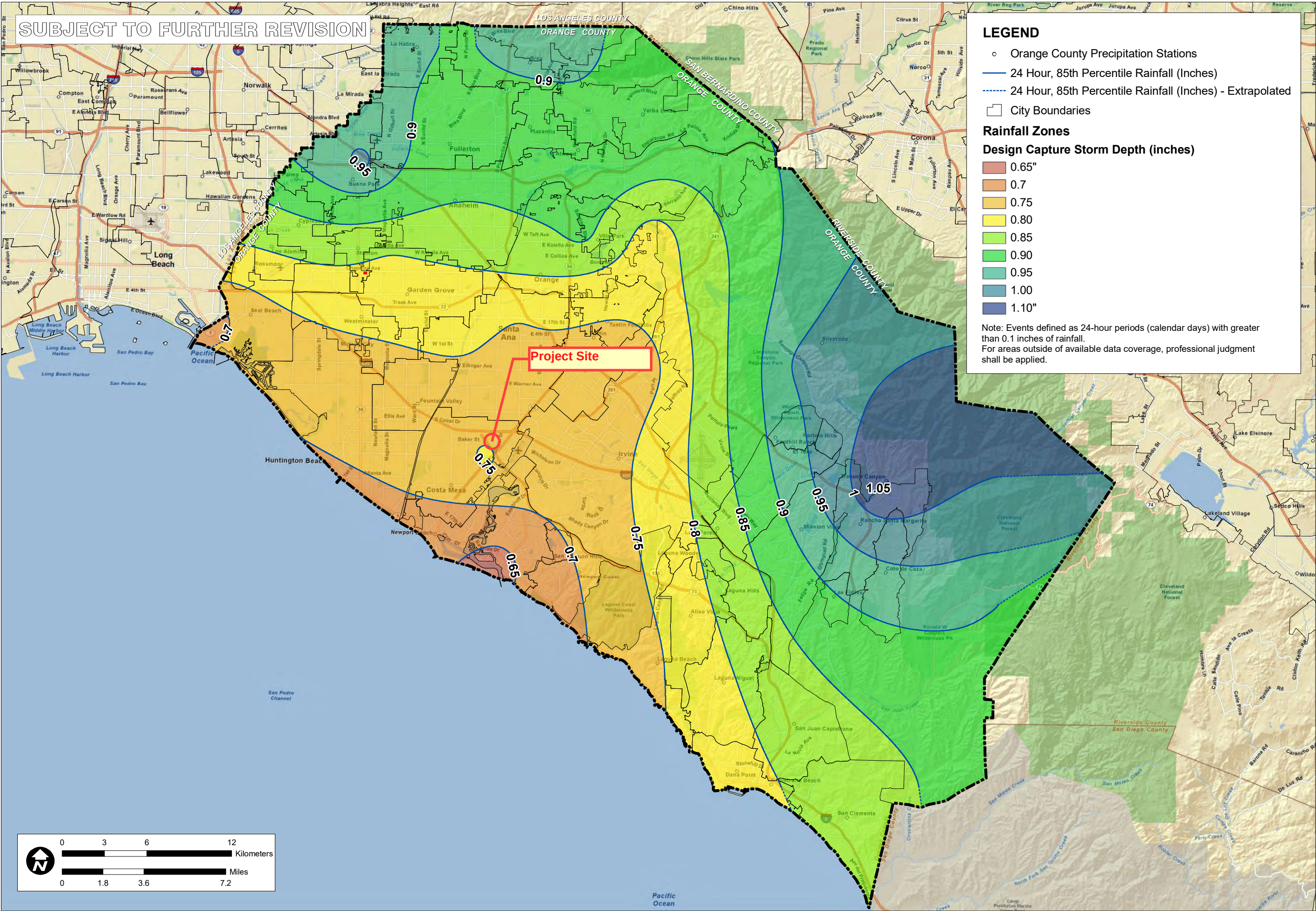
Worksheet B: Simple Design Capture Volume Sizing Method

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, d (inches)	$d=$	0.75	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	$d_{HSC}=$	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}=$	0.75	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), A (acres)	$A=$	0.79	acres
2	Enter Project Imperviousness, imp (unitless)	$imp=$	0.95	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	$C=$	0.86	
4	Calculate runoff volume, $V_{design}= (C \times d_{remainder} \times A \times 43560 \times (1/12))$	$V_{design}=$	1,857	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{observed}^1$ (in/hr) (Appendix VII) = avg. (0.41 + 1.07) / 2	$K_{observed}=$		In/hr
2	Enter combined safety factor from Worksheet H, S_{total} (unitless)	$S_{total}=$		
3	Calculate design infiltration rate, $K_{design} = K_{observed} / S_{total}$	$K_{design}=$		In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, T (max 48 hours)	$T=$		Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	$D_{max}=$		feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	$A_{min}=$		sq-ft

¹ $K_{observed}$ is the vertical infiltration measured in the field, before applying a factor of safety. If field testing measures a rate that is different than the vertical infiltration rate (for example, three-dimensional borehole percolation rate), then this rate must be adjusted by an acceptable method (for example, Porchet method) to yield the field estimate of vertical infiltration rate, $K_{observed}$. See Appendix VII.

ATTACHMENT C – OC TGD EXHIBITS/WORKSHEETS/CALCULATIONS

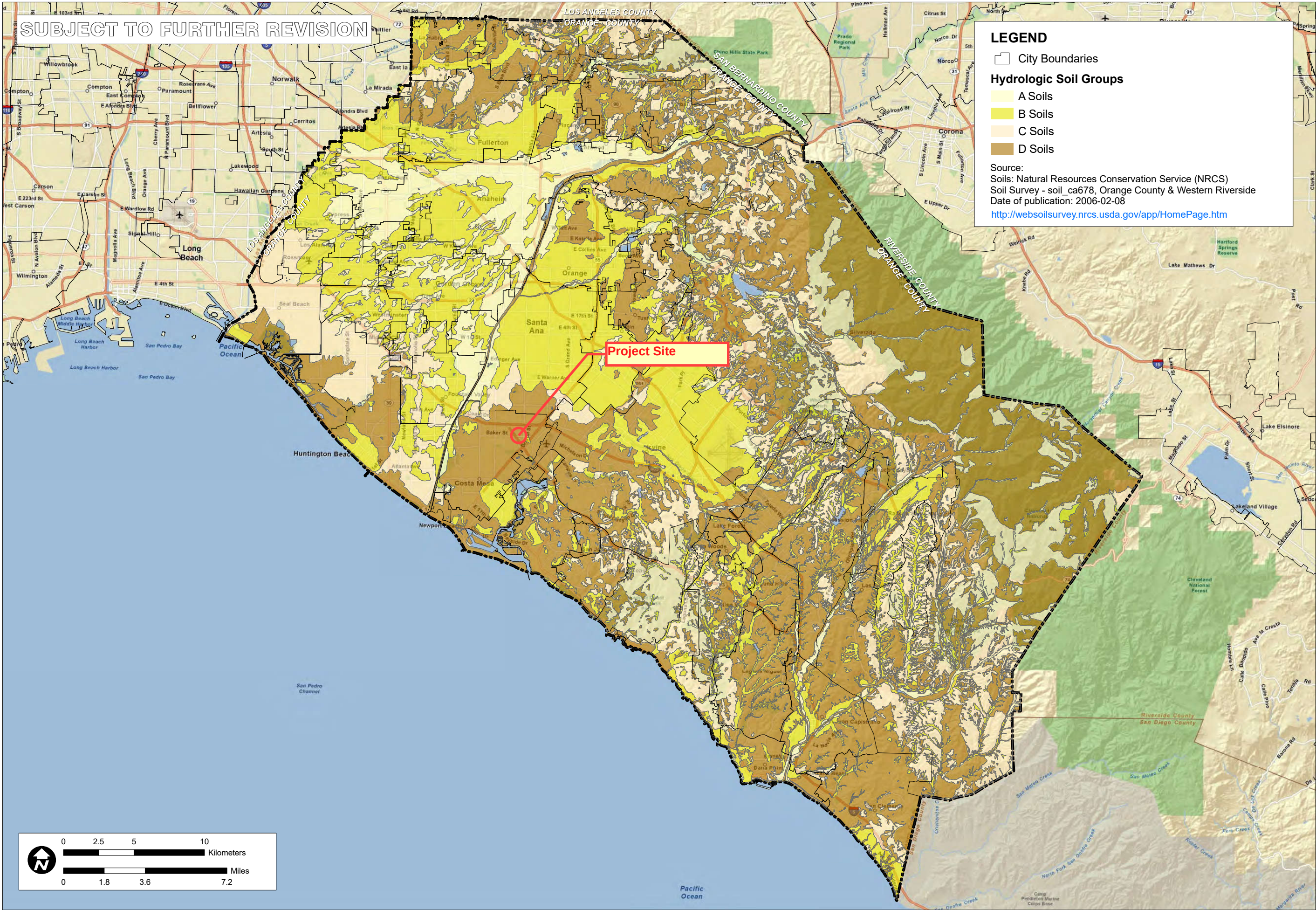
P:\9526\6-GIS\Wxd\Reports\InfiltrationFeasibility_20110215\9526E_FigureXVI-1_RainfallZones_20110215.mxd



ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT		RAINFALL ZONES	
JOB		TITLE	
SCALE 1" = 1.8 miles		CA	
DESIGNED TH	DRAWING TH	ORANGE CO.	
CHECKED BMP	DATE 04/22/10	JOB NO. 9526-E	
FIGURE		XVI-1	

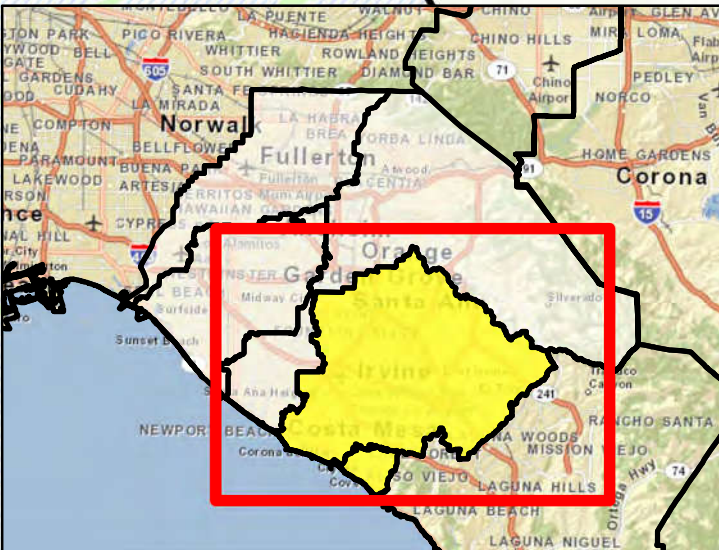
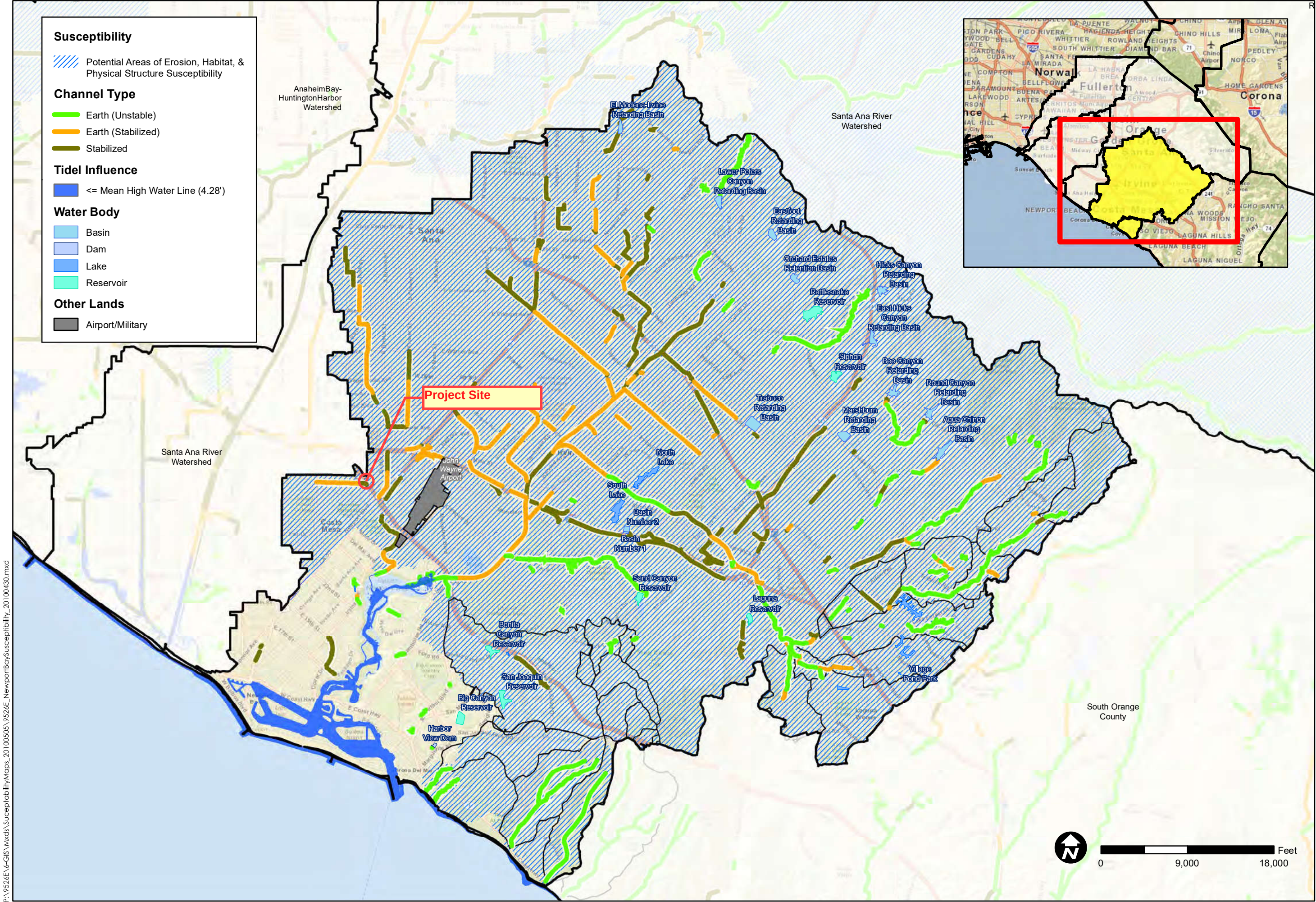
PACE
Advanced Water Engineering

P:\9526E\6-GIS\MapDocs\Reports\InfiltrationFeasibility_20110215\9526E_FigureXVI-2a_HydroSoils_20110215.mxd



		SCALE		1" = 1.8 miles	
		DESIGNED		TH	
		DRAWING		TH	
		CHECKED		BMP	
		DATE		02/09/11	
		JOB NO.		9526-E	
FIGURE		ORANGE CO.		JOB	
XVI-2a		ORANGE COUNTY INFILTRATION STUDY		TITLE	
		CA		NRCS HYDROLOGIC SOILS GROUPS	

P:\9526E\6-318\Wxds\Susceptibility\Maps_20100505\9526E_NewportBaySusceptibility_20100430.mxd



Susceptibility

Potential Areas of Erosion, Habitat, & Physical Structure Susceptibility

Channel Type

- Earth (Unstable)
- Earth (Stabilized)
- Stabilized

Tidel Influence

<= Mean High Water Line (4.28')

Water Body

- Basin
- Dam
- Lake
- Reservoir

Other Lands

Airport/Military



0 9,000 18,000 Feet

TITLE
SUSCEPTIBILITY ANALYSIS
NEWPORT BAY-
NEWPORT COASTAL STREAMS

JOB
ORANGE COUNTY
WATERSHED
MASTER PLANNING
ORANGE CO. CA

SCALE	1" = 12000'
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/30/10
JOB NO.	9526-E



FIGURE
4

Simple Runoff Coefficient Volume Calculation

[illegible]

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(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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Ver. 22.0 Release Date: 07/01/2015 License ID 1678

Analysis prepared by:

civTEC
999 Corporate Dr., Suite 100
Ladera Ranch, CA 92694
ph: 949.463.8822

***** DESCRIPTION OF STUDY *****
* COSTA MESA FIRE STATION NO. 2 *
* EXISTING CONDITION *
* 2-YEAR STORM EVENT *

FILE NAME: 17001E.DAT
TIME/DATE OF STUDY: 09:15 03/26/2026

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 2.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
DATA BANK RAINFALL USED
ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT-/PARK- SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER WIDTH (FT)	GEOMETRIES: LIP (FT)	MANNING HIKE (FT)	FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 1.01 TO NODE 1.02 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 195.00
ELEVATION DATA: UPSTREAM(FEET) = 41.30 DOWNSTREAM(FEET) = 38.00

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 5.665
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 2.107
SUBAREA T_c AND LOSS RATE DATA (AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS T_c
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL D 0.65 0.20 0.100 75 5.66
SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
SUBAREA RUNOFF(CFS) = 1.22
TOTAL AREA(ACRES) = 0.65 PEAK FLOW RATE(CFS) = 1.22

FLOW PROCESS FROM NODE 2.01 TO NODE 2.02 IS CODE = 21

```

-----
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH( FEET) =      32.00
ELEVATION DATA:  UPSTREAM( FEET) =      41.40  DOWNSTREAM( FEET) =      41.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =      5.000
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.264
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp      Ap      SCS      Tc
LAND USE              GROUP  (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
APARTMENTS              D      0.13      0.20      0.200      75  5.00
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA RUNOFF(CFS) =      0.26
TOTAL AREA(ACRES) =      0.13  PEAK FLOW RATE(CFS) =      0.26
=====
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =      0.13  TC(MIN.) =      5.00
EFFECTIVE AREA(ACRES) =      0.13  AREA-AVERAGED Fm(INCH/HR)= 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.20  AREA-AVERAGED Ap = 0.200
PEAK FLOW RATE(CFS)   =      0.26
=====
END OF RATIONAL METHOD ANALYSIS

```

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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Ver. 22.0 Release Date: 07/01/2015 License ID 1678

Analysis prepared by:

civTEC
999 Corporate Dr., Suite 100
Ladera Ranch, CA 92694
ph: 949.463.8822

***** DESCRIPTION OF STUDY *****
* COSTA MESA FIRE STATION NO. 2 *
* PROPOSED CONDITION *
* 2-YEAR STORM EVENT *

FILE NAME: 17001P.DAT
TIME/DATE OF STUDY: 09:16 03/26/2026

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 2.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
DATA BANK RAINFALL USED
ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT-/PARK- SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER GEOMETRIES: WIDTH LIP HIKE (FT) (FT) (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00 0.0313 0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 1.01 TO NODE 1.02 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 50.00
ELEVATION DATA: UPSTREAM(FEET) = 41.90 DOWNSTREAM(FEET) = 40.86

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 5.000
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 2.264
SUBAREA T_c AND LOSS RATE DATA (AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS T_c
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL D 0.06 0.20 0.100 75 5.00
SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
SUBAREA RUNOFF(CFS) = 0.12
TOTAL AREA (ACRES) = 0.06 PEAK FLOW RATE(CFS) = 0.12

FLOW PROCESS FROM NODE 1.02 TO NODE 1.03 IS CODE = 41

```

-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 38.70 DOWNSTREAM(FEET) = 36.83
FLOW LENGTH(FEET) = 170.00 MANNING'S N = 0.011
DEPTH OF FLOW IN 8.0 INCH PIPE IS 1.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 2.49
GIVEN PIPE DIAMETER(INCH) = 8.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 0.12
PIPE TRAVEL TIME(MIN.) = 1.14 Tc(MIN.) = 6.14
LONGEST FLOWPATH FROM NODE 1.01 TO NODE 1.03 = 220.00 FEET.

*****
FLOW PROCESS FROM NODE 1.03 TO NODE 1.03 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
MAINLINE Tc(MIN.) = 6.14
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.012
SUBAREA LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
COMMERCIAL D 0.21 0.20 0.100 75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.21 SUBAREA RUNOFF(CFS) = 0.38
EFFECTIVE AREA(ACRES) = 0.27 AREA-AVERAGED Fm(INCH/HR) = 0.02
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 0.3 PEAK FLOW RATE(CFS) = 0.48

*****
FLOW PROCESS FROM NODE 1.03 TO NODE 1.04 IS CODE = 41
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 36.83 DOWNSTREAM(FEET) = 34.75
FLOW LENGTH(FEET) = 170.00 MANNING'S N = 0.011
DEPTH OF FLOW IN 8.0 INCH PIPE IS 3.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 3.93
GIVEN PIPE DIAMETER(INCH) = 8.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 0.48
PIPE TRAVEL TIME(MIN.) = 0.72 Tc(MIN.) = 6.86
LONGEST FLOWPATH FROM NODE 1.01 TO NODE 1.04 = 390.00 FEET.

*****
FLOW PROCESS FROM NODE 1.04 TO NODE 1.04 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
MAINLINE Tc(MIN.) = 6.86
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.888
SUBAREA LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
COMMERCIAL D 0.09 0.20 0.100 75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.09 SUBAREA RUNOFF(CFS) = 0.15
EFFECTIVE AREA(ACRES) = 0.36 AREA-AVERAGED Fm(INCH/HR) = 0.02
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 0.4 PEAK FLOW RATE(CFS) = 0.61

*****
FLOW PROCESS FROM NODE 1.04 TO NODE 1.04 IS CODE = 81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
MAINLINE Tc(MIN.) = 6.86
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.888

```

```
SUBAREA LOSS RATE DATA(AMC II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp      Ap      SCS
    LAND USE          GROUP (ACRES) (INCH/HR) (DECIMAL) CN
COMMERCIAL            D      0.39      0.20      0.100    75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.39      SUBAREA RUNOFF(CFS) = 0.66
EFFECTIVE AREA(ACRES) = 0.75      AREA-AVERAGED Fm(INCH/HR) = 0.02
AREA-AVERAGED Fp(INCH/HR) = 0.20  AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 0.8      PEAK FLOW RATE(CFS) = 1.26
=====
END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 0.8      TC(MIN.) = 6.86
EFFECTIVE AREA(ACRES) = 0.75  AREA-AVERAGED Fm(INCH/HR)= 0.02
AREA-AVERAGED Fp(INCH/HR) = 0.20  AREA-AVERAGED Ap = 0.100
PEAK FLOW RATE(CFS) = 1.26
=====
END OF RATIONAL METHOD ANALYSIS
```

Table 2.7: Infiltration BMP Feasibility Worksheet

	Infeasibility Criteria	Yes	No
1	Would Infiltration BMPs pose significant risk for groundwater related concerns? Refer to Appendix VIII (Worksheet I) for guidance on groundwater-related infiltration feasibility criteria.		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
2	Would Infiltration BMPs pose significant risk of increasing risk of geotechnical hazards that cannot be mitigated to an acceptable level? (Yes if the answer to any of the following questions is yes, as established by a geotechnical expert): • The BMP can only be located less than 50 feet away from slopes steeper than 15 percent • The BMP can only be located less than eight feet from building foundations or an alternative setback. • A study prepared by a geotechnical professional or an available watershed study substantiates that stormwater infiltration would potentially result in significantly increased risks of geotechnical hazards that cannot be mitigated to an acceptable level.		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
3	Would infiltration of the DCV from drainage area violate downstream water rights?		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

	<i>Partial Infeasibility Criteria</i>	Yes	No
4	Is proposed infiltration facility located on HSG D soils or the site geotechnical investigation identifies presence of soil characteristics which support categorization as D soils?	X	
Provide basis: Per NOC TGD Figure XVI-2a. Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
5	Is measured infiltration rate below proposed facility less than 0.3 inches per hour? This calculation shall be based on the methods described in Appendix VII .		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
6	Would reduction of over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
7	Would an increase in infiltration over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

Infiltration Screening Results (check box corresponding to result):		
8	Is there substantial evidence that infiltration from the project would result in a significant increase in I&I to the sanitary sewer that cannot be sufficiently mitigated? (See Appendix XVII) Provide narrative discussion and supporting evidence: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.	No.
9	If any answer from row 1-3 is yes: infiltration of any volume is not feasible within the DMA or equivalent. Provide basis: Summarize findings of infeasibility screening	No.
10	If any answer from row 4-7 is yes, infiltration is permissible but is not presumed to be feasible for the entire DCV. Criteria for designing biotreatment BMPs to achieve the maximum feasible infiltration and ET shall apply. Provide basis: Summarize findings of infeasibility screening	Yes.
11	If all answers to rows 1 through 11 are no, infiltration of the full DCV is potentially feasible, BMPs must be designed to infiltrate the full DCV to the maximum extent practicable.	

Harvest and Use Infeasibility

Harvest and use infeasibility criteria include:

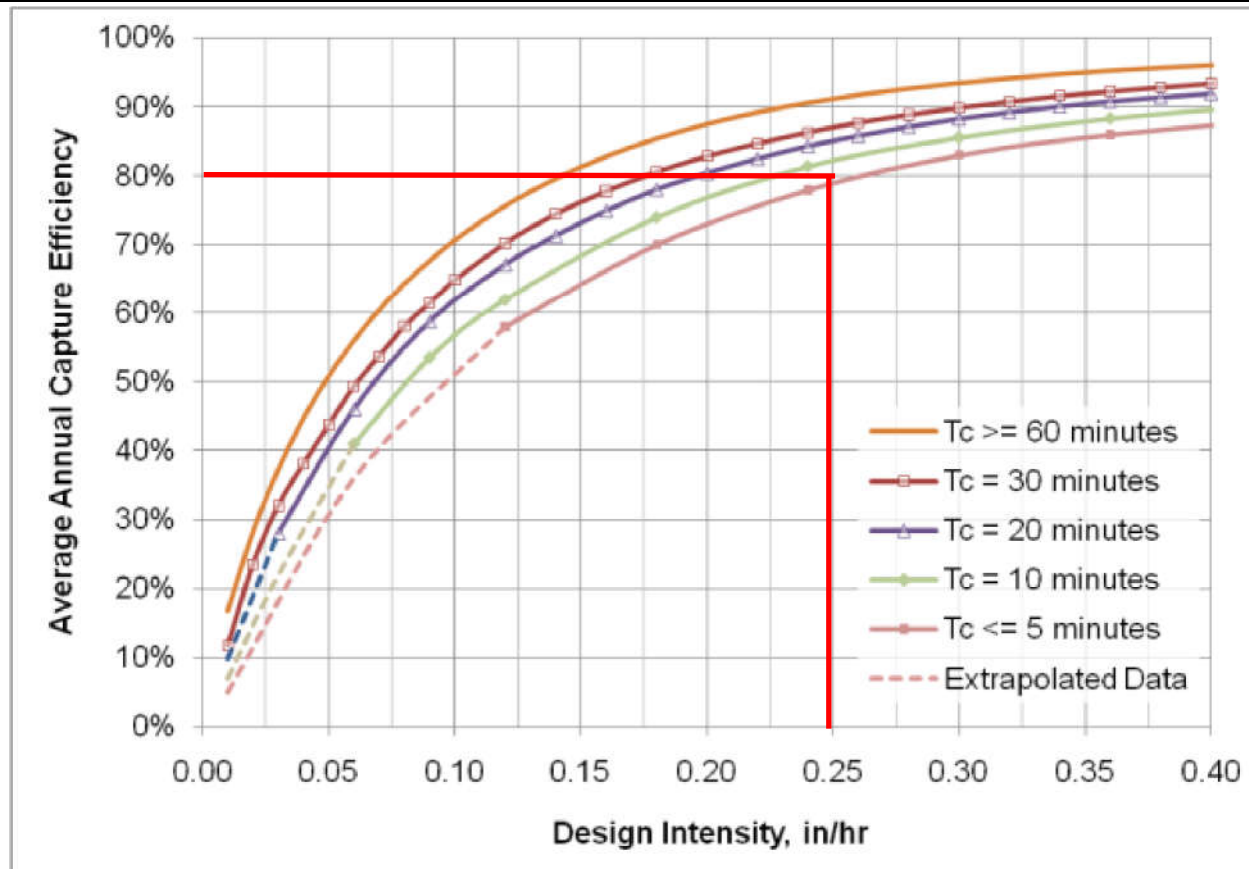
- If inadequate demand exists for the use of the harvested rainwater. See [Appendix X](#) for guidance on determining harvested water demand and applicable feasibility thresholds.
- If the use of harvested water for the type of demand on the project violates codes or ordinances most applicable to stormwater harvesting in effect at the time of project application and a waiver of these codes and/or ordinances cannot be obtained. It is noted that codes and ordinances most applicable to stormwater harvesting may change

Worksheet D: Capture Efficiency Method for Flow-Based BMPs (MWS Sizing Calculation)

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter the time of concentration, T_c (min) (See Appendix IV.2)	$T_c =$	6.9	
2	Using Figure III.4 , determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	$I_1 =$	0.25	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	$d_{HSC} =$	0	inches
4	Enter capture efficiency corresponding to d_{HSC} , Y_2 (Worksheet A)	$Y_2 =$		%
5	Using Figure III.4 , determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency (Y_2), I_2	$I_2 =$		
6	Determine the design intensity that must be provided by BMP, $I_{design} = I_1 - I_2$	$I_{design} =$	0.25	
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), A (acres)	$A =$	0.79	acres
2	Enter Project Imperviousness, imp (unitless)	$imp =$	0.95	
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	$C =$	0.86	
4	Calculate design flowrate, $Q_{design} = (C \times I_{design} \times A)$	$Q_{design} =$	0.170	cfs
Supporting Calculations				
Describe system: MWS 8x8 unit is proposed. 8x8 unit has a treatment capacity of 0.231 cfs, which is larger than design flowrate of 0.170 cfs.				
Provide time of concentration assumptions: See Rational Method Hydrology for proposed condition for 2-year storm in Appendix C Proposed 2-year Storm $T_c = 6.9$ minutes.				

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

Graphical Operations



Provide supporting graphical operations. See Example [III.7](#).

Assumed Tc of 5 minutes --> Design Intensity of 0.26

MWS LINEAR 2.0 HGL SIZING CALCULATIONS																																				
MWS MODEL SIZE	WETLAND PERMITER LENGTH	LOADING RATE GPM/SF	HGL HEIGHT																								STANDARD HEIGHT MODEL	HIGH CAPACITY MODELS								
			SHALLOW MODELS																				HIGH CAPACITY MODELS													
			1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.65		3.70	3.75	3.80	3.85	3.90	3.95			
MWS-L-4-4	6.70	1.0	0.022	0.023	0.025	0.026	0.028	0.029	0.031	0.032	0.034	0.035	0.037	0.038	0.040	0.042	0.043	0.045	0.046	0.048	0.049	0.051	0.052	0.054	0.055	0.056	0.057	0.058	0.059	0.060	0.061					
MWS-L-4-6	9.30	1.0	0.030	0.032	0.034	0.036	0.038	0.041	0.043	0.045	0.047	0.049	0.051	0.053	0.055	0.058	0.060	0.062	0.064	0.066	0.068	0.070	0.073	0.075	0.077	0.078	0.079	0.080	0.081	0.082	0.083	0.084				
MWS-L-4-8	14.80	1.0	0.048	0.051	0.054	0.058	0.061	0.065	0.068	0.071	0.075	0.078	0.082	0.085	0.088	0.092	0.095	0.099	0.102	0.105	0.109	0.112	0.115	0.119	0.122	0.124	0.126	0.127	0.129	0.131	0.132	0.134				
MWS-L-4-13	18.40	1.0	0.059	0.063	0.068	0.072	0.076	0.080	0.084	0.089	0.093	0.097	0.101	0.106	0.110	0.114	0.118	0.122	0.127	0.131	0.135	0.139	0.144	0.148	0.152	0.154	0.156	0.158	0.160	0.163	0.165	0.167				
MWS-L-4-15	22.40	1.0	0.072	0.077	0.082	0.087	0.093	0.098	0.103	0.108	0.113	0.118	0.123	0.129	0.134	0.139	0.144	0.149	0.154	0.159	0.165	0.170	0.175	0.180	0.185	0.188	0.190	0.193	0.195	0.198	0.200	0.203				
MWS-L-4-17	26.40	1.0	0.085	0.091	0.097	0.103	0.109	0.115	0.121	0.127	0.133	0.139	0.145	0.151	0.158	0.164	0.170	0.176	0.182	0.188	0.194	0.200	0.206	0.212	0.218	0.221	0.224	0.227	0.230	0.233	0.236	0.239				
MWS-L-4-19	30.40	1.0	0.098	0.105	0.112	0.119	0.126	0.133	0.140	0.147	0.153	0.160	0.167	0.174	0.181	0.188	0.195	0.202	0.209	0.216	0.223	0.230	0.237	0.244	0.251	0.255	0.258	0.262	0.265	0.269	0.272	0.276				
MWS-L-4-21	34.40	1.0	0.111	0.118	0.126	0.134	0.142	0.150	0.158	0.166	0.174	0.182	0.189	0.197	0.205	0.213	0.221	0.229	0.237	0.245	0.253	0.261	0.268	0.276	0.284	0.288	0.292	0.296	0.300	0.304	0.308	0.312				
MWS-L-6-8	18.80	1.0	0.060	0.065	0.069	0.073	0.078	0.082	0.086	0.091	0.095	0.099	0.104	0.108	0.112	0.116	0.121	0.125	0.129	0.134	0.138	0.142	0.147	0.151	0.155	0.157	0.160	0.162	0.164	0.166	0.168	0.170				
MWS-L-8-8	29.60	1.0	0.095	0.102	0.109	0.115	0.122	0.129	0.136	0.143	0.149	0.156	0.163	0.170	0.177	0.183	0.190	0.197	0.204	0.211	0.217	0.224	0.231	0.238	0.245	0.248	0.251	0.255	0.258	0.262	0.265	0.268				
MWS-L-8-12	44.40	1.0	0.143	0.153	0.163	0.173	0.183	0.194	0.204	0.214	0.224	0.234	0.245	0.255	0.265	0.275	0.285	0.296	0.306	0.316	0.326	0.336	0.346	0.357	0.367	0.372	0.377	0.382	0.387	0.392	0.397	0.402				
MWS-L-8-16	59.20	1.0	0.190	0.204	0.217	0.231	0.245	0.258	0.272	0.285	0.299	0.312	0.326	0.340	0.353	0.367	0.380	0.394	0.408	0.421	0.435	0.448	0.462	0.476	0.489	0.496	0.503	0.509	0.516	0.523	0.530	0.537				
MWS-L-8-20	74.00	1.0	0.238	0.255	0.272	0.289	0.306	0.323	0.340	0.357	0.374	0.391	0.408	0.425	0.442	0.459	0.476	0.493	0.509	0.526	0.543	0.560	0.577	0.594	0.611	0.620	0.628	0.637	0.645	0.654	0.662	0.671				
MWS-L-10-20 or MWS-L-8-24	88.80	1.0	0.285	0.306	0.326	0.346	0.367	0.387	0.408	0.428	0.448	0.469	0.489	0.509	0.530	0.550	0.571	0.591	0.611	0.632	0.652	0.673	0.693	0.713	0.734	0.744	0.754	0.764	0.774	0.785	0.795	0.805				
4'x'4 media cage	14.80	1.0	0.048	0.051	0.054	0.058	0.061	0.065	0.068	0.071	0.075	0.078	0.082	0.085	0.088	0.092	0.095	0.099	0.102	0.105	0.109	0.112	0.115	0.119	0.122	0.124										

1-Year, 1-Hour Storm Flowrate

	A (acres)	A (SF)	Pervious	Impervious	Imperviousness	C	i	Q
DMA A	0.79	34520	1810	32710	0.95	0.86	0.382	0.261
	0.79	34520	1810	32710				

State Water Resources Control Board

Certified Trash Full Capture Systems Available to the Public (Updated November 2025)

Trash Provisions

Any trash treatment system installed after December 2, 2015, must be certified by the State Water Resources Control Board (State Water Board) Executive Director, or designee, prior to installation. The certification documents that it meets the full capture system definition and qualifies as a trash full capture system (System) as defined in the Trash Provisions.¹ The Trash Provisions define a full capture system as a treatment control, or series of treatment controls, including but not limited to, a multi-benefit project or a low impact development control that traps all particles that are 5-millimeter or greater, and has a design treatment capacity that is either:

1. Of not less than the peak flow rate resulting from a one-year, one-hour storm event (design storm) in the subdrainage area, or
2. Appropriately sized and designed to carry at least the same flows as the corresponding storm drain.

Consistent with these requirements, the Systems shall not bypass trash below the design storm under maximum operational loading conditions and shall not have a diversion structure present upstream such that a portion of the peak flow is not treated to trap all particles 5-millimeter or greater.

¹ Amendment to the Water Quality Control Plan for Ocean Waters of California to Control Trash and Part 1 Trash Provisions of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California adopted by the State Water Board located on the Statewide Water Quality Control Plans for Trash webpage at:
https://www.waterboards.ca.gov/water_issues/programs/trash_control/documentation.html

Certified Trash Full Capture Systems Available to the Public

Vector Control Accessibility

According to the California Health and Safety Code,² California landowners are legally responsible to abate (eliminate the source of) a public nuisance arising from their property, including mosquitoes. Mosquito vector control districts have substantial authority to access public and private property, inspect known or suspected sources of mosquitoes, abate mosquito sources, and charge the landowner for work performed and/or charge fees if a landowner is unwilling or unable to address a mosquito source arising from their property.

If not designed properly, a System may impede the mosquito vector control district's ability to (1) visually inspect the System and/or storm vault for mosquito breeding, and (2) apply the appropriate chemical treatment. Moreover, some Systems may create a habitat for mosquitoes.

All the Systems in the tables below were reviewed and approved by the Mosquito Vector Control Association of California for vector control accessibility. However, prior to installation of any Systems, contact the local mosquito vector control district to ensure the installation conforms to the local district's visual inspection, treatment, and vector breeding minimizing guidelines. The Mosquito Vector Control Association of California may also be contacted via email at Trashtreatment@mvcac.org.

Certified Trash Full Capture System Tables

The Systems included in the tables below are: 1) new Systems certified by the State Water Board Executive Director after adoption of the Trash Provisions, and 2) legacy Systems that were certified pursuant to the Trash Provisions, including those full capture systems that were listed in Appendix I of the Bay Area-wide Trash Capture Demonstration Project, Final Project Report (May 8, 2014). All Systems remain certified unless and until they are decertified by the State Water Board's Executive Director or designee. Legacy Systems' descriptions are included in "fact sheets" that have been updated to address the application requirements for new Systems.

Categorically Certified Multi-Benefit Trash Treatment Systems, a subset of full capture systems, are listed separately on the State Water Board's [Trash Implementation Program](#) webpage. Additionally, the tables do not include the Department of Transportation's Systems, as its Systems are not available to the public.

Systems are either identified by their application number or, for legacy Systems, by a fact sheet alpha numeric designation.

Please note: Only Systems originally manufactured or distributed by the listed applicants are certified full capture systems.

² Health & Safety Code sections 2001-2002, 2060-2067, 100170, and 131075.

Certified Trash Full Capture Systems Available to the Public

The alphabetical tables of System applicants are divided into two categories:

- *Catch Basin Inserts and Other Insert Systems*. These Systems typically are inserted into existing stormwater infrastructure; and
- *High Flow Capacity Trash Full Capture Systems*. These Systems are generally self-contained units that typically are not inserted into existing stormwater infrastructure and that are designed to treat trash from large drainage areas.

How to Access Certified System Applications and Legacy System Fact Sheets

Other than those applications pertaining to the Department of Transportation's certified Systems, certified System applications and legacy System fact sheets are available at the California Stormwater Quality Association's trash webpage:

<https://www.casqa.org/resources/trash/certified-full-capture-system-trash-treatment-control-devices>. To obtain the Department of Transportation's certified applications, please send an email to DWQ-Trash-Program-MS4@Waterboards.ca.gov.

Questions concerning the Trash Provisions and the tables below should be emailed to our Help Desk at DWQ-Trash-Program-MS4@Waterboards.ca.gov.

Certified Trash Full Capture Systems Available to the Public

TABLE 1. Catch Basin Inserts and Other Insert Systems

Applicant/Owner	Full Capture System Name	Date of Application Certification and Update (if applicable), or Fact Sheet Update	Date of Vector Control Accessibility Approval
AbTech Industries, Inc.	Ultra Urban Filter Curb Opening and Drop-In	Application 25 06/30/2020	04/08/2020
Advanced Drainage Systems, Inc.	FLEXSTORM Full Trash Capture Inserts	Application 3 03/15/2018 Updated 04/21/2021 Updated 12/20/2024 Decertified 06/05/2025 Recertified 08/14/2025	03/30/2021 Updated 12/03/2024 Decertified 06/05/2025 Recertified 07/15/2025
Advanced Drainage Systems, Inc.	FLEXSTORM Full Trash Capture Inserts for Round and Nyloplast Basins	Application 52 09/17/2025	08/21/2025
Advanced Drainage Systems, Inc.	FLEXSTORM Connector Pipe Screen	Fact Sheet ADS-1 Updated 06/08/2021 Updated 05/20/2024 Updated 11/01/2024	Updated 10/10/2024
Bio Clean® Environmental Services, Inc.	Curb Inlet and Grate Inlet Filters	Application 4 03/15/2018 Updated 10/21/2021 Updated 04/29/2024	Updated 04/25/2024

Certified Trash Full Capture Systems Available to the Public

Applicant/Owner	Full Capture System Name	Date of Application Certification and Update (if applicable), or Fact Sheet Update	Date of Vector Control Accessibility Approval
Hydra TMDL Systems (Previously certified as Bio Clean® Environmental Services, Inc.)	Connector Pipe Screen	Fact Sheet BC-3 Updated 04/30/2020 Updated 05/01/2024	Updated 05/01/2024
BrightWater™	Connector Pipe Screen	Application 29 03/15/2018 Updated 12/29/2020	11/19/2020
BrightWater™	Curb Inlet Filter	Application 26 06/30/2020	04/17/2020
Ecology Control Industries	Debris Dam - Catch Basin Insert for Curb Inlet Design	Fact Sheet ECI-1 12/02/2015 Updated 06/17/2020	04/29/2020
Enviropod® International: A Stormwater 360 Group Company	Enviropod® LittaTrap™ Full Capture	Application 27 10/14/2020 Updated 12/20/2024	07/20/2020 Updated 12/03/2024
Fabco Industries, Inc.	Fabco Connector Pipe Screen	Application 36 Updated 2/07/2024 Updated 04/25/2024 Updated 08/19/2024	Updated 08/07/2024

Certified Trash Full Capture Systems Available to the Public

Applicant/Owner	Full Capture System Name	Date of Application Certification and Update (if applicable), or Fact Sheet Update	Date of Vector Control Accessibility Approval
Fabco Industries, Inc.	Fabco Expanding StormRing CPS	Application 42 09/25/2023 Updated 04/01/2025 Updated 07/10/2025	08/28/2023 Updated 03/25/2025 Updated 06/10/2025
Fabco Industries, Inc.	Fabco Ready-Fit StormSack	Application 41 06/16/2023	6/12/2023
Fabco Industries, Inc.	Fabco ScreenBox	Application 37 10/13/2022 Updated 12/20/2024	10/05/22 Updated 12/03/2024
Fabco Industries, Inc.	Fabco StormBasin	Application 38 10/13/2022	10/05/2022
Fabco Industries, Inc.	Fabco StormSack	Application 39 10/13/2022 Updated 12/20/2024	10/05/2022 Updated 12/03/2024
Fabco Industries, Inc.	Fabco StormTrough	Application 43 Updated 08/19/2024 Updated 04/01/2025	11/1/2023 Updated 09/27/2024 Updated 03/25/2025

Certified Trash Full Capture Systems Available to the Public

Applicant/Owner	Full Capture System Name	Date of Application Certification and Update (if applicable), or Fact Sheet Update	Date of Vector Control Accessibility Approval
Filtrexx® Sustainable Technologies	StormExx® Clean	Application 16 08/10/2018 Updated 11/25/2019	12/06/2019
Frog Creek Partners, LLC	Gutter Bin® Channel Filtration System and Mundus Bag® Water Filter	Application 22 06/26/2019	04/19/2019
Frog Creek Partners, LLC	Gutter Bin® Eco Curb Inlet Filter and Mundus Bag® Water Filter	Application 23 02/18/2019	10/14/2019
Frog Creek Partners, LLC	Gutter Bin® Eco Drop Inlet Filter and Mundus Bag® Water Filter	Application 24 02/18/2020	12/06/2019
G2 Construction, Inc.	G2 CPS-Mod™ and Removable CPS-Mod™ Screen	Application 18 06/26/2019	03/15/2019
G2 Construction, Inc.	G2 Grated Inlet Trash Screen	Application 19 06/26/2019	04/10/2019
Hydra TMDL Systems	Drop-in Horizontal Grate Inlet Filter Basket and Wall Mounted Curb Inlet Filter Basket	Application 55 11/21/2025	10/09/2025
Hydroworks, LLC	HydroDome TR	Application 44 04/30/2024	04/18/2024

Certified Trash Full Capture Systems Available to the Public

Applicant/Owner	Full Capture System Name	Date of Application Certification and Update (if applicable), or Fact Sheet Update	Date of Vector Control Accessibility Approval
Inventive Resources, Inc.	Water Decontaminator	Application 2 03/15/2018 Updated 02/05/2021	04/20/2020
Kai Pono Solutions	Standard Basic System	Application 45 06/14/2024	06/10/2024
Oldcastle Infrastructure	FloGard® + Plus® Catchbasin Trash Screen Insert, Combination Inlet Style Drop in Basket	Fact Sheet OI-1 12/02/2015 Updated 06/09/2021	06/09/2021
Oldcastle Infrastructure	FloGard® Catchbasin Trash Screen Insert, Flat Grated Inlet Style Drop in Basket	Fact Sheet OI-2 12/02/2015 Updated 06/09/2021	06/09/2021
Oldcastle Infrastructure	FloGard® Catchbasin Outlet Trash Screen Insert Connector Pipe Screen	Fact Sheet OI-3 Updated 01/29/2019 Updated 04/01/2025	12/06/2019 Updated 03/18/2025
Revel Environmental Manufacturing, Inc.	Triton™ Bioflex Inlet Trash Guard Catchbasin Polyester Fiber Mesh Trash Filter Insert	Fact Sheet REM-1 12/02/2015 Updated 09/10/2021	09/07/2021
Revel Environmental Manufacturing, Inc.	Triton™ Crescent Pipe Screen	Application 12 07/10/2018 Updated 08/12/2024	08/14/2024

Certified Trash Full Capture Systems Available to the Public

Applicant/Owner	Full Capture System Name	Date of Application Certification and Update (if applicable), or Fact Sheet Update	Date of Vector Control Accessibility Approval
Revel Environmental Manufacturing, Inc.	Triton™ Perf-Full Trash Capture Insert	Application 13 07/10/2018 Updated 12/21/2021	12/20/2021
Safe Drain Stormwater Holdings, Inc.	Storm Vector Guard	Application 30 02/11/2021	12/17/2020
SOP Technologies	Stormwater Catch Basin Treatment System	Application 51 06/09/2025	05/30/2025
Stormtek	Stormtek ST3 & ST3G Catchbasin Connector Pipe	Fact Sheet AS-1, A1S-2 12/02/2015 Updated 08/12/2021	08/04/2021
United Stormwater, Inc.	Connector Pipe Trash Screen	Fact Sheet USW-1 12/02/2015 Updated 01/29/2022	01/26/2022

Certified Trash Full Capture Systems Available to the Public

TABLE 2. High Flow Capacity Trash Full Capture Systems

Applicant/Owner	Full Capture System Name	Date of Application Certification and Update (if applicable), or Fact Sheet Update	Date of Vector Control Accessibility Approval
Advanced Drainage Systems, Inc.	Arcadia Hydrodynamic Separator	Application 54 10/15/2025	09/16/2025
Advanced Drainage Systems, Inc.	Barracuda Hydrodynamic Separator	Application 21 06/26/2019 Updated 05/21/2021	03/15/2019 Updated 05/21/2021
AquaShield, Inc.	Aqua-Swirl® Stormwater Treatment System	Application 1 08/04/2017 Updated 01/06/2023	12/03/2020 Updated 01/06/2023
Bio Clean® Environmental Services, Inc.	Debris Separating Baffle Box	Application 6 03/15/2018	07/28/2020
Bio Clean® Environmental Services, Inc.	Bio Clean® Deflective Screening Device	Application 20 06/26/2019	07/28/2020
Bio Clean® Environmental Services, Inc.	Modular Wetland System®	Application 15 07/10/2018	03/15/2019

Certified Trash Full Capture Systems Available to the Public

Applicant/Owner	Full Capture System Name	Date of Application Certification and Update (if applicable), or Fact Sheet Update	Date of Vector Control Accessibility Approval
Coanda Inc.	Coanda Trash Screen and Debris Fence	Fact Sheet COA-1 12/02/2015 Updated 09/10/2021	09/07/2021
Contech Engineered Solutions	Continuous Deflective Separator Hydrodynamic Separator	Fact Sheet CCP-1HF 12/02/2015 Updated 05/27/2021	04/29/2021
Jensen® Stormwater Systems	Jensen® Deflective Separators	Application 5 03/15/2018	12/06/2019
Hydro International®	Downstream Defender® (In-Line and Off-Line Configurations)	Application 14 07/10/2018	03/16/2020
Hydro International®	First Defense® High-Capacity Full Trash Capture Device	Application 28 10/30/2020	08/20/2020
Hydro International®	Hydro Up-Flo Filter®	Application 11 07/18/2018	03/16/2020

Certified Trash Full Capture Systems Available to the Public

Applicant/Owner	Full Capture System Name	Date of Application Certification and Update (if applicable), or Fact Sheet Update	Date of Vector Control Accessibility Approval
Hydro International®	Hydro DryScreen®	Application 10 07/10/2018 Updated 05/05/2021	04/29/2021
Hydroworks, LLC	HydroDome® TS	Application 46 9/26/2024	08/14/2024
Oldcastle Infrastructure	FloGard® NetTech	Fact Sheet OI-11HF 12/02/2015 Updated 02/08/2020	12/03/2020
Oldcastle Infrastructure	Nutrient Separating Baffle Box®	Application 17 10/12/2018 Updated 07/21/2020	07/20/2020
Roscoe Moss Company	Storm Flo® Trash Screen – Linear Radial Gross Solids Removal Device	Fact Sheet RMC-1HF 12/02/2015 Updated 03/30/2021	03/11/2021
StormTrap®, LLC	SiteSaver®	Application 9 03/15/2018 Updated 02/23/2021	03/18/2021

Certified Trash Full Capture Systems Available to the Public

Applicant/Owner	Full Capture System Name	Date of Application Certification and Update (if applicable), or Fact Sheet Update	Date of Vector Control Accessibility Approval
StormTrap®, LLC	StormSettler Hydrodynamic Separator	Application 49 04/14/2025	04/03/2025
StormTrap®, LLC	TrashTrap® Net and Fixed Basket In-Line Stormwater Treatment System	Application 34 06/21/2022	05/03/2022
StormTrap®, LLC	TrashTrap® Net and Fixed Basket End-of-Pipe Stormwater Treatment System	Application 35 07/06/2022	06/01/2022

Table X.8: Minimum Irrigated Area for Potential Partial Capture Feasibility

General Landscape Type	Conservation Design: $K_L = 0.35$			Active Turf Areas: $K_L = 0.7$		
<i>Closest ET Station</i>	<i>Irvine</i>	<i>Santa Ana</i>	<i>Laguna</i>	<i>Irvine</i>	<i>Santa Ana</i>	<i>Laguna</i>
Design Capture Storm Depth, inches	Minimum Required Irrigated Area per Tributary Impervious Acre for Potential Partial Capture, ac/ac					
0.60	0.66	0.68	0.72	0.33	0.34	0.36
0.65	0.72	0.73	0.78	0.36	0.37	0.39
0.70	0.77	0.79	0.84	0.39	0.39	0.42
0.75	0.83	0.84	0.90	0.41	0.42	0.45
0.80	0.88	0.90	0.96	0.44	0.45	0.48
0.85	0.93	0.95	1.02	0.47	0.48	0.51
0.90	0.99	1.01	1.08	0.49	0.51	0.54
0.95	1.04	1.07	1.14	0.52	0.53	0.57
1.00	1.10	1.12	1.20	0.55	0.56	0.60

Worksheet J: Summary of Harvested Water Demand and Feasibility

1	What demands for harvested water exist in the tributary area (check all that apply):			
2	Toilet and urinal flushing		☐	
3	Landscape irrigation		☒	
4	Other: _____		☐	
5	What is the design capture storm depth? (Figure III.1)	d	0.75	inches
6	What is the project size?	A	0.79	ac
7	What is the acreage of impervious area?	IA	0.74	ac
For projects with multiple types of demand (toilet flushing, indoor demand, and/or other demand)				
8	What is the minimum use required for partial capture? (Table X.6)			gpd
9	What is the project estimated wet season total daily use?			gpd
10	Is partial capture potentially feasible? (Line 9 > Line 8?)			
For projects with only toilet flushing demand				
11	What is the minimum TUTIA for partial capture? (Table X.7)			
12	What is the project estimated TUTIA?			

Worksheet J: Summary of Harvested Water Demand and Feasibility

13	Is partial capture potentially feasible? (Line 12 > Line 11?)		
For projects with only irrigation demand			
14	What is the minimum irrigation area required based on conservation landscape design? (Table X.8)	0.62	ac
15	What is the proposed project irrigated area? (multiply conservation landscaping by 1; multiply active turf by 2)	0.05	ac
16	Is partial capture potentially feasible? (Line 15 > Line 14?)	No	
Provide supporting assumptions and citations for controlling demand calculation:			

ATTACHMENT D – OPERATION AND MAINTENANCE (O & M) PLAN

Operation & Maintenance Plan

For

Costa Mesa Fire Station No. 2

800 Baker Street

Costa Mesa, CA 92626

Owner & Responsible Party

City of Costa Mesa
77 Fair Dr.
Costa Mesa, CA 92626

Responsible Entity for Funding

City of Costa Mesa

BMP	Inspection/Maintenance Activities Required	Frequency of Activities
N1 Education for Property Owners, Tenants and Occupants N12 Employee Training	Owner will ensure that all employees and contractors will be given a copy of the educational materials and activity restrictions. Brochures can be downloaded from www.ocwatersheds.com and are attached as Attachment E on the project-specific WQMP.	Educational materials will be provided to employees and contractors at hire and annually, thereafter
N2 Activity Restrictions	The restricted activities include, but not limited to the following: car washing, cleaning trash cans with water, use of	Continuous

	chemical/additives when washing concrete sidewalks.	
N3 Common Area Landscape Management	All landscape maintenance activities will conform to the Orange County Management Guidelines for the use of fertilizers and pesticides.	Weekly
N4 BMP Maintenance	See O&M plan	Continuous
N10 Uniform Fire Code Implementation	Comply with Article 80 of the Uniform Fire Code.	Continuous
N11 Common Area Litter Control	Weekly sweeping and trash pickup as necessary within all project areas.	Daily inspection and daily clean up and as needed
N14 Common Area Catch Basin Inspection	Remove trash and debris from catch basins and grates. Check for damage, clogging, and standing water. Repair or mitigate clogging/standing water, as needed.	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events >0.5 inches
N15 Street Sweeping Private Streets and Parking Lots	Monthly sweeping/vacuuming of paved areas.	Monthly
S1 Storm Drain Stenciling and Signage	Check that all catch basins in paved areas marked or stenciled with "No dumping-Drains to Ocean" language. Replace/repaint markings if faded, damaged, removed, or otherwise illegible.	Annually

Modular Wetlands System (MWS)	See attached manufacturer's documents	Per manufacturer's recommendations
----------------------------------	---------------------------------------	--

Owner & Responsible Entity for Maintenance

City of Costa Mesa
77 Fair Dr.
Costa Mesa, CA 92626

Responsible Entity for Funding

City of Costa Mesa

Long Term BMP Maintenance

The City of Costa Mesa is aware of the maintenance responsibilities of the proposed BMPs. A funding mechanism is in place to maintain the BMPs at the frequency stated in the WQMP.

Record Keeping

The City of Costa Mesa shall retain records of inspection and maintenance for at least 5 years and be made available for review by regulatory agencies.

All training and educational activities and BMP operation and maintenance shall be documented to verify compliance with this O&M Plan. See attached sample Training Log and Inspection and Maintenance Log.

BMP INSPECTION, OPERATION & MAINTENANCE LOG

Today's Date: _____

Name of Person Performing Activity
(Printed): _____

Signature: _____

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

TRAINING / EDUCATIONAL LOG

Date of Training/Educational Activity: _____

**Name of Person Performing Activity
(Printed):** _____

Signature: _____

Topic of Training/Educational Activity: _____

Name of Participant	Signature of Participant

Modular Wetlands[®] Linear Operations & Maintenance Manual



MODULAR WETLANDS LINEAR OPERATION & MAINTENANCE MANUAL

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OVERVIEW

This operation and maintenance (O&M) manual is for the Modular Wetlands Linear Biofilter (MWL). Please read the instructions and equipment lists closely prior to starting. It is important to follow all necessary safety procedures associated with state and local regulations. Please contact Contech for more information on pre-authorized third-party service providers who can provide inspection and maintenance services in your area. For a list of service providers in your area, please visit www.conteches.com/maintenance.



WARNING

Confined space entry may be required. Contractor to obtain all equipment and training to meet applicable local and OSHA regulations regarding confined space entry. It is the Contractor's or entry personnel's responsibility to always proceed safely.

SAFETY NOTICE & PERSONAL SAFETY EQUIPMENT

Job site safety is a topic and a practice addressed comprehensively by others. The inclusions here are merely reminders to whole areas of Safety Practice that are the responsibility of the Owner(s), Manager(s), and Service Provider(s). OSHA and Canadian OSH, Federal, State/Provincial, and Local Jurisdiction Safety Standards apply on any given site or project. The knowledge and applicability of those responsibilities is the Service Provider's responsibility and outside the scope of Contech Engineered Solutions.



Safety Boots



Gloves



Hard Hat



Eye Protection

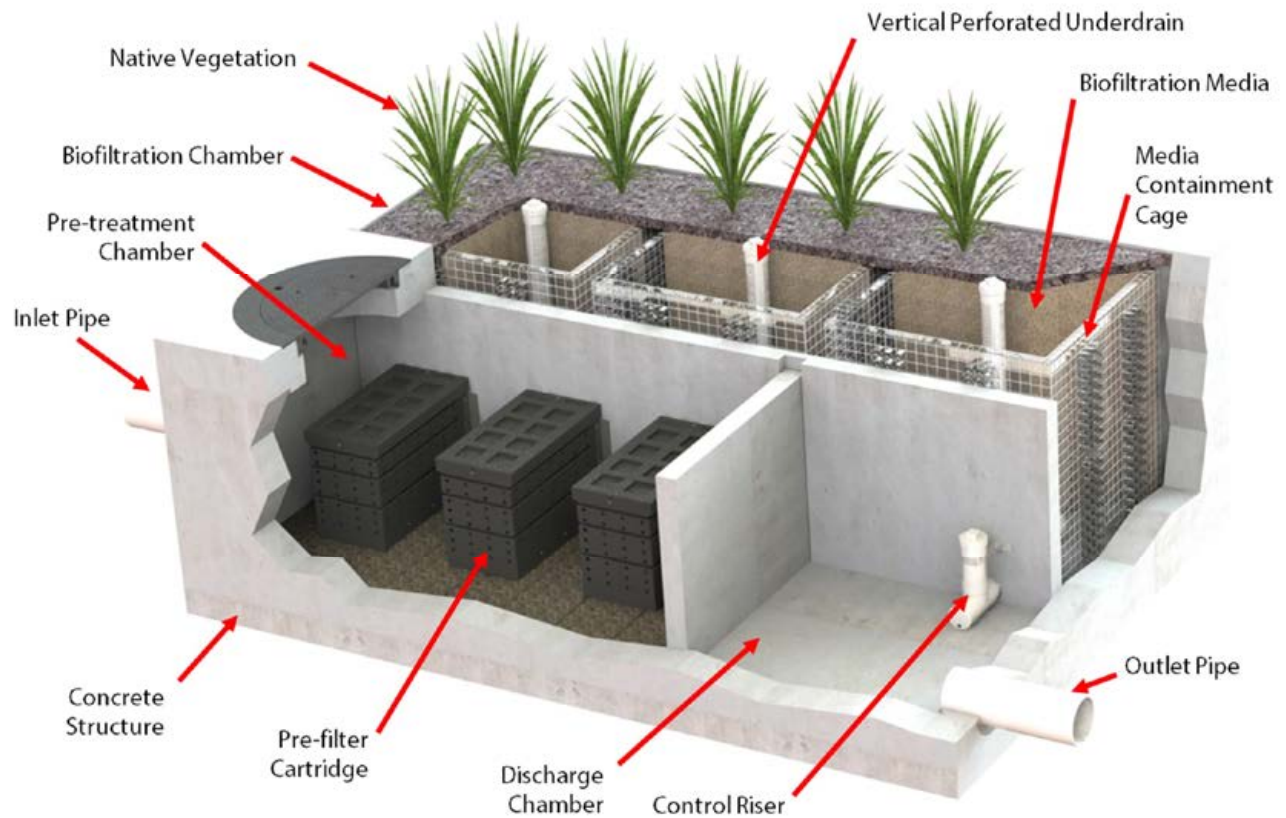


Maintenance and Protection
of Traffic Plan

MODULAR WETLANDS LINEAR COMPONENTS LIST

The MWL system comes in multiple sizes and configurations, including side by side or end to end layouts, both as open planters or underground systems. See shop drawings (plans) for project specific details.

The standard MWL system is comprised of the following components:



INSPECTION SUMMARY & EQUIPMENT LIST

Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site-specific loading conditions. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided.

- Inspect pre-treatment, biofiltration, and discharge chambers an average of once every six to twelve months. Varies based on site specific and local conditions.
- Average inspection time is approximately 15 minutes. Always ensure appropriate safety protocol and procedures are followed.

The following is a list of equipment required to allow for simple and effective inspection of the MWL:



Modular Wetlands Linear
Inspection Form



Flashlight



Tape Measure



Access Cover Hook



Ratchet
& 7/16" Socket
(if required for older pre-filter
cartridges that have two
bolts holding the lids on)

INSPECTION & MAINTENANCE NOTES

1. Following maintenance and/or inspection, it is recommended that the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.
2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.
3. Transport all debris, trash, organics, and sediments to approved facility for disposal in accordance with local and state requirements.
4. Entry into chambers may require confined space training based on state and local regulations.
5. No fertilizer shall be used in the biofiltration chamber.
6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may not require irrigation after initial establishment.

INSPECTION PROCESS

1. Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other information (see inspection form).
2. Observe the inside of the system through the access covers. If minimal light is available and vision into the unit is impaired, utilize a flashlight to see inside the system and all chambers.
3. Look for any out of the ordinary obstructions in the inflow pipe, pre-treatment chamber, biofiltration chamber, discharge chamber or outflow pipe. Write down any observations on the inspection form.
4. Through observation and/or digital photographs, estimate the amount of trash, debris accumulated in the pre-treatment chamber. Utilizing a tape measure or measuring stick, estimate the amount of sediment in this chamber. Record this depth on the inspection form.
5. Through visual observation, inspect the condition of the pre-filter cartridges. Look for excessive build-up of sediment on the cartridges, any build-up on the tops of the cartridges, or clogging of the holes. Record this information on the inspection form. The pre-filter cartridges can be further inspected by removing the cartridge tops and assessing the color of the BioMediaGREEN filter cubes (requires entry into pre-treatment chamber - see notes previous notes regarding confined space entry). Record the color of the material. New material is a light green color. As the media becomes clogged, it will turn darker in color, eventually becoming dark brown or black. The closer to black the media is the higher percentage that the media is exhausted and in need of replacement.



6. The biofiltration chamber is generally maintenance-free due to the system's advanced pre-treatment chamber. For units which have open planters with vegetation, it is recommended that the vegetation be inspected. Look for any plants that are dead or showing signs of disease or other negative stressors. Record the general health of the plants on the inspection form and indicate through visual observation or digital photographs if trimming of the vegetation is required.
7. The discharge chamber houses the control riser (if applicable), drain down filter (only in California - older models), and is connected to the outflow pipe. It is important to check to ensure the orifice is in proper operating condition and free of any obstructions. It is also important to assess the condition of the drain down filter media which utilizes a block form of the BioMediaGREEN. Assess in the same manner as the cubes in the pre-filter cartridge as mentioned above.
8. Finalize the inspection report for analysis by the maintenance manager to determine if maintenance is required.

MAINTENANCE INDICATORS

Based upon the observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components or cartridges.
- Obstructions in the system or its inlet and/or outlet pipes.
- Excessive accumulation of floatables in the pre-treatment chamber in which the length and width of the chamber is fully impacted more than 18".
- Excessive accumulation of sediment in the pre-treatment chamber of more than 6" in depth.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges. When media is more than 85% clogged, replacement is required. The darker the BioMediaGREEN, the more clogged it is and in need of replacement.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the drain down filter (California only - older models).
- Overgrown vegetation.

MAINTENANCE SUMMARY & EQUIPMENT LIST

The time has come to maintain your MWL. All necessary pre-maintenance steps must be carried out before maintenance occurs. Once traffic control has been set up per local and state regulations and access covers have been safely opened, the maintenance process can begin. It should be noted that some maintenance activities require confined space entry. All confined space requirements must be strictly followed before entry into the system. In addition, the following is recommended:

- Prepare the maintenance form by writing in the necessary information including project name, location, date & time, unit number and other info (see maintenance form).
- Set up all appropriate safety and maintenance equipment.
- Ensure traffic control is set up and properly positioned.
- Prepared pre-checks (OSHA, safety, confined space entry) are performed.
 - A gas meter should be used to detect the presence of any hazardous gases prior to entering the system. If hazardous gases are present, do not enter the vault. Following appropriate confined space procedures, take steps such as utilizing a venting system to address the hazard. Once it is determined to be safe, enter the system utilizing appropriate entry equipment such as a ladder and tripod with harness.

The following is a list of equipment required for maintenance of the MWL:



Modular Wetlands Linear
Maintenance Form



Flashlight



Access Cover Hook



Ratchet
& 7/16" Socket
(if required for older pre-filter
cartridges that have two
bolts holding the lids on)



Vacuum Assisted Truck with
Pressure Washer



Replacement
BioMediaGREEN
(If Required)

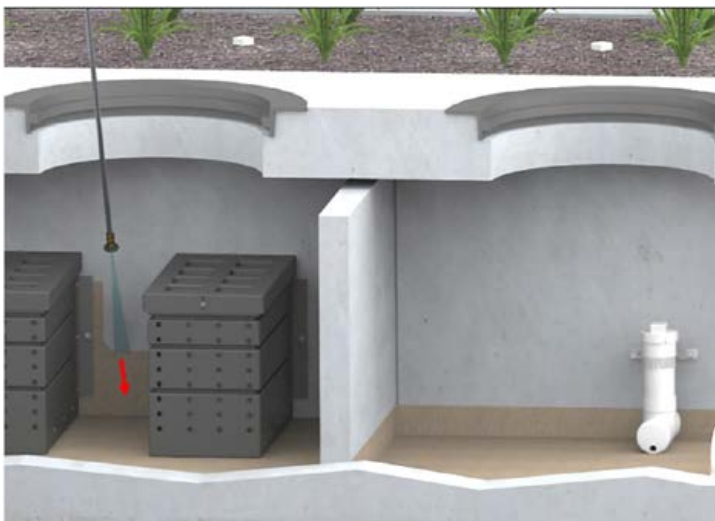
(order BioMediaGREEN from Contech's Maintenance Team members at <https://www.conteches.com/maintenance>)

MAINTENANCE INSTRUCTIONS



1. ACCESS COVER REMOVAL

Upon determining that the vault is safe for entry, remove all access cover(s) and position the vacuum truck accordingly.



2. PRESSURE WASH SYSTEM CHAMBERS

With the pressure washer, spray down pollutants accumulated on the walls and floors of the pre-treatment and discharge chambers. Then wash any accumulated sediment from the pre-filter cartridge(s).



3. VACUUM SYSTEM CHAMBERS

Vacuum out pre-treatment and discharge chambers and remove all accumulated pollutants including trash, debris, and sediments. Be sure to vacuum the pre-treatment floor until the pervious pavers are visible and clean. **(MWL systems outside of California may or may not have pervious pavers on the floor in the pre-treatment chamber)** If pre-filter cartridges require media replacement, proceed to **Step 4**. If not, replace the access cover(s) and proceed to **Step 7**.



4. PRE-FILTER CARTRIDGE LID REMOVAL

After successfully cleaning out the pre-treatment chamber, enter the chamber and remove the lid(s) from the pre-filter cartridge(s) by removing the two thumb screws. (Older pre-filter cartridges have two bolts holding the lids on that require a 7/16" socket to remove)



5. VACUUM EXISTING PRE-FILTER MEDIA

Utilize the vacuum truck hose or hose extension to remove the filter media from each of the individual media cages. Once filter media has been sucked out, use a pressure washer to spray down the inside of the cartridge and its media cages. Remove cleaned media cages and place to the side. Once removed, the vacuum hose can be inserted into the cartridge to vacuum out any remaining material near the bottom of the cartridge.



6. PRE-FILTER MEDIA REPLACEMENT

Reinstall media cages and fill with new media from the manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase. The easiest way to fill the media cages is to utilize a refilling tray that can also be sourced from the manufacturer. Place the refilling tray on top of the cartridge and fill with new bulk media shaking it down into the cages. Using your hands, lightly compact the media into each filter cage. Once the cages are full (each cartridge will hold five heaping 5gal buckets of bulk media), remove the refilling tray and replace the cartridge top, ensuring fasteners are properly tightened.



7. MAINTAINING VEGETATION

In general, the biofiltration chamber is maintenance-free with the exception of maintaining the vegetation. The MWL utilizes vegetation similar to surrounding landscape areas, therefore, trim vegetation to match surrounding vegetation. If any plants have died, replace them with new ones.



8. INSPECT UNDERDRAIN SYSTEM

Each vertical under drain on the biofiltration chamber has a removable threaded cap that can be taken off to check for any blockages or root growth. Once removed, a jetting attachment to the pressure washer can be used to clean out the under drain and orifice riser if needed.



9. REPLACE ACCESS COVERS

Once maintenance is complete, replace all access cover(s)

REPLACING BIOFILTRATION MEDIA IF REQUIRED

As with all biofilter systems, at some point the biofiltration media will need to be replaced, either due to physical clogging or sorptive exhaustion (for dissolved pollutants) of the media ion exchange capacity (to remove dissolved metals and phosphorous). The general life of this media is 10 to 20 years based on site specific conditions and pollutant loading, so replacing the biofiltration media should not be a common occurrence. In the event that the biofiltration media requires replacement, contact one of Contech's Maintenance Team members at <https://www.conteches.com/maintenance> to order new biofiltration media. The quantity of media needed can be determined by providing the model number and unit depth. Media will be provided in super sacks for easy installation. Each sack will weigh between 1,000 and 2,000 lbs. Biofiltration media replacement can be done following the steps below:



1. VACUUM EXISTING BIOFILTRATION MEDIA

Remove the mulch and vegetation to access the biofiltration media, and then position the vacuum truck accordingly. Utilize the vacuum truck to vacuum out all the media. Once all media is removed, use the pressure washer to spray down all the netting and underdrain systems on the inside of the media containment cage. Vacuum out any remaining debris after spraying down netting. Inspect the netting for any damage or holes. If the netting is damaged, it can be repaired or replaced with guidance by the manufacturer.



2. INSTALLING NEW BIOFILTRATION MEDIA

Ensure that the chamber is fully cleaned prior to installation of new media into the media containment cage(s). Media will be provided in super sacks for easy installation. A lifting apparatus (forklift, backhoe, boom truck, or other) is recommended to position the super sack over the biofiltration chamber. Add media in lifts to ensure that the riser pipes remain vertical. Be sure to only fill the media cage(s) up to the same level as the old media.



3. REPLANT VEGETATION

Once the media has been replaced, replant the vegetation and cover biofiltration chamber with approved mulch (if applicable). If the existing vegetation is not being reused, and new vegetation is being planted, you will need to acquire new plant establishment media that will be installed just below the mulch layer at each plant location. (see plan drawings for details). Contact one of Contech's Maintenance Team members at <https://www.conteches.com/maintenance> to order new plant establishment media.

REPLACING DRAIN DOWN FILTER MEDIA (ONLY ON OLDER CALIFORNIA MODELS)

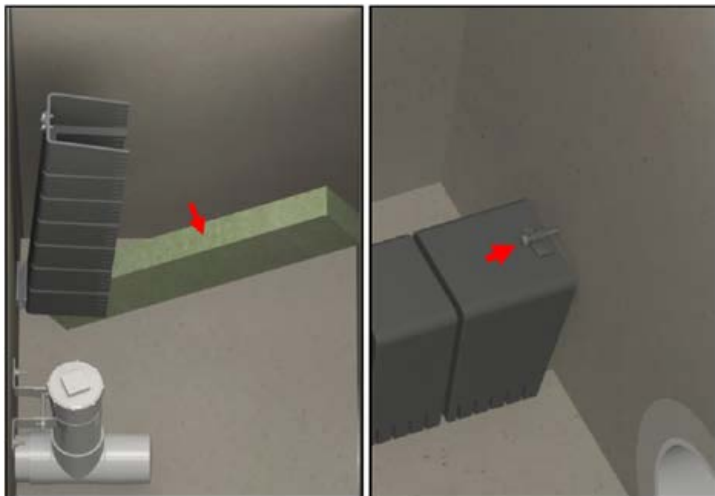
NOTE: The drain down filter is only found on units installed in California prior to 2023

If during inspection it was determined that the drain down filter media requires replacement, contact one of Contech's Maintenance Team members at <https://www.conteches.com/maintenance> to order new media.



1. REMOVE EXISTING DRAIN DOWN MEDIA

Pull knob back to unlock the locking mechanism and lift the drain down filter housing to remove the used BioMediaGREEN filter block.



2. INSTALL NEW DRAIN DOWN MEDIA

Ensure that the chamber and housing are fully cleaned prior to installation of new media, and then insert the new BioMediaGREEN filter block. The media filter block should fit snugly between the chamber walls and be centered under the filter housing. Lower the housing over the filter block and secure the locking mechanism.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Inspection Report Modular Wetlands Linear

Project Name _____		For Office Use Only (Reviewed By) _____ (Date) _____ Office personnel to complete section to the left.
Project Address _____ (city) (Zip Code)		
Owner / Management Company _____		
Contact _____	Phone () - _____	
Inspector Name _____	Date ____ / ____ / ____	Time ____ AM / PM
Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes		
Weather Condition _____		Additional Notes _____

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

Structural Integrity:	Yes	No	Comments
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	Yes	No
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____

Cleaning and Maintenance Report Modular Wetlands Linear

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____

Phone () -

Inspector Name _____

Date ____ / ____ / ____ Time ____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint

☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____

Additional Notes _____

For Office Use Only
(Reviewed By)
(Date) Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat:	MWS Catch Basins						
	Long:							
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:



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SUPPORT

DRAWINGS AND SPECIFICATIONS ARE AVAILABLE AT WWW.CONTECHES.COM

ModWetLinear OM Manual 03/24

ATTACHMENT E - GEOTECHNICAL REPORT (FOR REFERENCE ONLY)



GEOTECHNICAL INVESTIGATION
PROPOSED COSTA MESA FIRE STATION NO. 2
REPLACEMENT
800 BAKER STREET
COSTA MESA, ORANGE COUNTY, CALIFORNIA

Prepared For **PBK ARCHITECTS**
8163 Rochester Avenue, Suite 100
Rancho Cucamonga, California 91730

Prepared By **LEIGHTON CONSULTING, INC.**
10532 Acacia Street, Suite B-6
Rancho Cucamonga, California 91730

Project No. 038.0000024475

July 25, 2024

July 25, 2024

Project No. 038.0000024475

PBK Architects
8163 Rochester Avenue, Suite 100
Rancho Cucamonga, California 91730

Attention: Mr. Kelley Needham, AIA
Principal

Subject: Geotechnical Investigation
Proposed Costa Mesa Fire Station No. 2 Replacement
800 Baker Street
Costa Mesa, Orange County, California

Leighton Consulting, Inc. (Leighton) is pleased to present this geotechnical investigation report in support of the proposed Costa Mesa Fire Station No. 2 Replacement project to be located at 800 Baker Street in the City of Costa Mesa, Orange County, California. The purpose of our geotechnical investigation has been to evaluate the geologic hazards and geotechnical conditions of the site with respect to the proposed improvements and to provide geotechnical recommendations for design and construction.

The site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone and no known active faults have been mapped through or trending toward the site. However, as is the case for most of southern California, strong ground shaking has and will occur at this site. The site has been mapped to be outside of a State liquefaction susceptibility zone based on our review of Earthquake Zones of Required Investigations for the Newport Beach Quadrangle (see Figure 5, *Seismic Hazards Map*). The site has also been mapped by the State to have a historically highest groundwater table of approximately 20 feet below ground surface based on our review of the Seismic Hazard Report for the Anaheim and Newport Beach 7.5-Minute Quadrangle. Groundwater was encountered within 2 of our 4 borings at depths ranging from approximately 24 to 25 feet below ground surface.

Based on this investigation, the proposed fire station building may be founded on conventional spread footings bearing solely on a zone of newly excavated and

recompacted fill soils derived from onsite soils, overlying undisturbed native soils. This report addresses these and other geotechnical aspects of the project.

We appreciate this opportunity to be of additional service to PBK Architects. If you have any questions or if we can be of further service, please contact us at your convenience at **866-LEIGHTON**, directly at the phone extensions or e-mail addresses listed below.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

A handwritten signature in blue ink, appearing to read "Jose Tapia".

Jose Tapia, PE 91630
Senior Project Engineer
Extension 8786,
jtapia@leightongroup.com

A handwritten signature in blue ink, appearing to read "Jason D. Hertzberg".

Jason D. Hertzberg, GE 2711
Principal Engineer
Extension 8772,
jhertzberg@leightongroup.com

A handwritten signature in blue ink, appearing to read "S. Okubo".

Steven G. Okubo, CEG 2706
Associate Geologist
Extension 8773,
sokubo@leightongroup.com

BTM/AA/JAT

Distribution: Addressee (via e-mail PDF)

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1.0 INTRODUCTION

1.1 **Site Location and Description**

The proposed fire station is to be constructed within an approximately 0.8-acre property located at 800 Baker Street in the City of Costa Mesa, California (see Figure 1, *Site Location Map*). The proposed fire station site is bounded by Randolph Avenue to the north, Baker Street to the south and multi-family residential properties to the east and west. Based on our review of the current elevation model from Google Earth and published topographic maps, the proposed fire station site is generally flat-lying at an elevation of approximately 37 to 40 feet above mean sea level (msl).

Based on our review of historical aerial imagery dating as far back as 1938 (NETR, 2024), the site was primarily open and undeveloped land until sometime between 1938 and 1952, when development began in and around the site vicinity for the development of single-family residential homes. Removal of the single-family homes and development of the existing fire station appeared to have occurred sometime between 1963 and 1972. The site has undergone only minor site improvements until present date.

1.2 **Proposed Development**

Our understanding of the project is based on email correspondence with you and the provided *Proposed Site Plan*, dated January 3, 2024. Preliminary site layouts depict an approximately 9,000-SF fire station building to replace the existing fire station building. The proposed structure will house new dormitories, bathrooms, offices, conference room, exercise room, day room, dining room/kitchen, laundry room, and a 3,725 SF apparatus bay within the central portion of the building. Also planned are two new equipment pads for a fuel tank and an emergency generator towards the southwestern portion of the site, an outdoor patio to the north side of the building. Visitor and crew parking lots, site fencing, sliding security gates, and a new driveway are also proposed. Ancillary improvements are anticipated to include landscaping, a trash enclosure, and associated underground utilities.

The proposed fire station replacement is to be constructed within the overall approximately 0.8-acre site and slated to replace the existing approximately 6,800-square-foot (SF) fire station building. We understand a temporary fire station and

apparatus bay are to be placed towards the northwest portion of the site until the replacement fire station has been completed.

Structural loading of the proposed building foundations has not been provided to us at the time of this report. We assume that the structures will be relatively lightly loaded.

1.3 **Purpose and Scope of Exploration**

The purpose of our exploration has been to: (1) evaluate geotechnical conditions of the site with respect to the proposed improvements, (2) identify significant geotechnical and geologic issues that would impact proposed improvements, and (3) provide preliminary geotechnical recommendations for design and construction of proposed improvements as currently planned. In accordance with our June 5, 2024, proposal, the scope of our exploration included the following:

- **Research:** We reviewed readily available maps, reports, and historical aerial photographs relevant to this project. Pertinent geotechnical documents are referenced at the end of this report text.
- **Field Exploration:** On June 17, 2024, four (4) hollow-stem auger borings (LB-1 through LB-4) were drilled with a truck-mounted drill rig, each logged and sampled to total depths ranging from approximately 10 feet to 51.5 feet below the existing ground surface (bgs). Encountered earth materials were logged in the field by our field representative and described in accordance with the Unified Soil Classification System (ASTM D2488). Relatively undisturbed soil samples were obtained at selected intervals within these borings using both a ring-lined Modified California split-barrel sampler and an unlined, 2-inch outside diameter Standard Penetration Test (SPT) split-spoon sampler. Although the SPT sampler we used had room for a liner, no liner was used as is customary for this type of work in this area. Sampling resistance blow counts were obtained by dropping a 140-pound, automatic-trip hammer through a 30-inch free fall onto a sampling rod anvil. Modified California and SPT samplers were driven 18 inches and the number of blows was recorded for each 6 inches of penetration. Both sampling methods generally followed respective ASTM D3550 and ASTM D1586 procedures. Representative bulk soil samples were also collected at shallow depths.

Infiltration testing was conducted within LB-3 and LB-4, which were converted into temporary wells IT-1 and IT-2, respectively. Testing was conducted at test zones located between 5 to 10 feet bgs for IT-1 and depths of 10 to 15 feet bgs for IT-2 to estimate the infiltration characteristics of the underlying soil at locations and depths tested. These infiltration tests were conducted in general conformance with Orange County Guidelines.

After drilling, sampling, logging, and infiltration testing, all borings were immediately backfilled with soils generated from drilling activities and patched at the surface with cold-mix asphalt to match existing conditions. Logs of our geotechnical borings and infiltration measurements collected in the field are presented in Appendix A, *Geotechnical Exploration Logs*. The approximate boring locations are shown on the accompanying Figure 2, *Exploration Location Map*.

- **Geotechnical Laboratory Testing:** Geotechnical laboratory tests were conducted on selected relatively undisturbed and bulk soil samples obtained during our field exploration. Our laboratory testing program was designed to evaluate engineering characteristics of onsite soils. A description of test procedures and results are presented in Appendix B, *Geotechnical Laboratory Testing*.
- **Engineering and Geologic Analysis:** Data obtained from our field exploration and geotechnical laboratory testing were evaluated and analyzed to develop geotechnical conclusions and provide recommendations.
- **Report Preparation:** Results of our geologic hazards review and geotechnical exploration have been summarized in this report, presenting our findings, conclusions, and preliminary geotechnical design recommendations.

This report does not address the potential for encountering hazardous materials in site soils or within groundwater. Important information about limitations of geotechnical reports in general, is presented in Appendix E, *GBA's Important Information About This Geotechnical-Engineering Report*.

2 . 0 F I N D I N G S

2.1 **Regional Geologic Setting**

The project is located in the Peninsular Ranges geomorphic province of southern California, on the Newport Mesa of the Los Angeles Basin in western Orange County (Yerkes et al., 1965). The Newport Mesa is located east of the current channel of the Santa Ana River and west and north of Newport Bay. This mesa is composed of Pleistocene age tidal flat deposits that have been uplifted by the Quaternary development of the northwest-plunging San Joaquin Hills anticline. The dextral Newport-Inglewood-Rose Canyon fault zone trends along this anticlinal axis and its potentially active segments are located as close as approximately 1.7-mile southwest of Costa Mesa Fire Station No. 2. The San Joaquin Hills thrust fault is located approximately 0.8-miles north of the site.

Figure 4, Regional Fault and Historical Seismicity Map illustrates regional active and potentially active fault traces with respect to the site location.

2.2 **Subsurface Soil Conditions**

Based on results of our research and subsurface exploration, site soils encountered to the depths explored (51.5 feet bgs) consisted of the following:

- **Undocumented Fill (Afu):** We are unaware of any documentation of previous fill placement for this site, so we have characterized all fill onsite as undocumented. Undocumented artificial fill was encountered in our borings to be generally about 5 to 7.5 feet thick. Undocumented fill encountered in our borings consisted primarily of very stiff, reddish brown sandy clay (CL).
- **Old Paralic Deposits overlain by Alluvial-Fan Deposits (Qopf):** The site has been regionally mapped to be underlain by old paralic deposits that have been overlain by alluvial fan deposits. These soils were encountered in our borings below undocumented fill and consisted generally of medium stiff to very stiff sandy silt and clay with sand to explored depths. Occasional interbedded sand and silty sand were encountered. Moisture contents from the underlying alluvial soils within the upper 10 feet ranged from values of 10 to 21 percent moisture and in situ dry densities ranged from 103 to 119 pcf.

More detailed descriptions of subsurface soils encountered are presented on our boring logs in Appendix A.

2.3 **Groundwater**

Groundwater was encountered in 2 of our 4 borings (LB-1 and LB-2) drilled on June 17, 2024, at depths ranging from approximately 24 to 25 feet below the existing ground surface (bgs). According to the Seismic Hazard Zone Report for the Anaheim and Newport Beach 7.5-Minute Quadrangles (CGS, 1997), the historically highest groundwater level at the site was on the order of 20 feet below ground surface.

Based on our borings and historical groundwater data, groundwater is not expected to be a significant constraint for development nor is anticipated to be encountered during construction activities for the proposed fire station building.

2.4 **Faulting and Seismicity**

Southern California is a seismically active area. As such, the site will be subject to seismic hazards from numerous sources in the area. The severity of potential seismic hazards is related to site-specific geology, distances from seismic sources, and the magnitude of earthquake events. Principal seismic hazards evaluated on a site-specific basis included: potential for surface rupture along active or potentially active fault traces, magnitude of seismic shaking, and the susceptibility to ground failure (liquefaction, lurching, and seismically induced landslides). Site-specific faulting and seismicity considerations are discussed in the following two subsections:

2.4.1 Surface Fault Rupture: Fault classification criteria adopted by the California Geological Survey, formerly the California Division of Mines and Geology, defines Earthquake Fault Zones along active or potentially active faults. The California Alquist-Priolo Earthquake Fault Zoning Act of 1972 classification system is used in this report, as follows:

- **Active:** An active fault is one that has ruptured within the Holocene epoch (the last 11,700 years).
- **Potentially Active:** A fault that has ruptured during the last 1.8 million years (Quaternary period) but has not been proven by direct evidence to have not moved within the Holocene epoch is considered to be potentially active.

- **Inactive:** A fault that has not moved during both Pleistocene and Holocene epochs (that is, no movement within the last 1.8 million years) is considered to be inactive.

This project lies outside of any State designated Earthquake Fault Zones (CGS, 1998). Based on our review of available in-house literature, and as depicted on Figure 4, *Regional Faults and Historical Seismicity Map*, there are no currently known active fault traces that traverse or trend towards this site. The Third California Earthquake Rupture Forecast (UCERF3) has estimated locations of potential fault rupture outside or trending outside the project site.

The closest known active or potentially active fault is the San Joaquin Hills blind thrust located approximately 0.8 mile north of the project site. Other known regional active or potentially active faults that could produce the most significant ground shaking at the site include those related to the Newport-Inglewood fault zone, the Palos Verde fault zone, and the Elsinore fault zone.

Nearby fault traces have been depicted in Figure 4, *Regional Fault and Historical Seismicity Map*.

- 2.4.2 Seismicity (Ground Shaking):** A principal seismic hazard that could impact this site is ground shaking resulting from an earthquake occurring along several major active or potentially active faults throughout southern California. An evaluation of historical seismicity from significant past earthquakes related to the site was performed. Plotted on Figure 4, *Regional Fault and Historical Seismicity Map*, are epicenters of historic earthquakes in and around Costa Mesa, color-coded as a function of magnitude. Based on this map, it appears that the site has not been exposed to relatively significant seismic events. We are unaware of documentation indicating that past earthquake damage has occurred in the site vicinity. In addition, we are unaware of damage in the site vicinity as the result of liquefaction, lateral spreading, or other related phenomena.

2.5 Secondary Seismic Hazards

In general, secondary seismic hazards for sites in this region could include soil liquefaction, earthquake-induced settlement, slope instability and landslides, earthquake-induced seiches and tsunamis flooding. Site-specific potential for secondary seismic hazards is discussed in the following subsections:

2.5.1 Liquefaction Potential: Liquefaction is the loss of soil strength due to a buildup of excess pore-water pressure during strong and long-duration ground shaking. Liquefaction is associated primarily with loose (low density), saturated, relatively uniform fine- to medium-grained, clean cohesionless soils. As shaking action of an earthquake progresses, soil granules are rearranged, and the soil densifies within a short period. This rapid densification of soil results in a buildup of pore-water pressure. When the pore-water pressure approaches the total overburden pressure, soil shear strength reduces abruptly and temporarily behaves similar to a fluid. For liquefaction to occur there must be:

- (1) loose, clean granular soils,
- (2) shallow groundwater, **and**
- (3) strong, long-duration ground shaking

The State of California has evaluated the site for liquefaction hazards and the site is **not** within a mapped liquefaction susceptibility zone (CGS, 1998). Groundwater was encountered in our borings at a depth of approximately 24 feet bgs. The site has been mapped with the historically highest groundwater table on the order of 20 feet below ground surface based on our review of the Seismic Hazard Report for the Anaheim and Newport Beach 7.5-Minute Quadrangle (CGS, 1997).

Our analysis was based on the modified Seed Simplified Procedure as detailed by Youd et al. (2001) and Martin and Lew (1999), which compares the seismic demand on a soil layer (Cyclic Stress Ratio, or CSR) to the capacity of the soil to resist liquefaction (Cyclic Resistance Ratio, or CRR) (Youd et al., 2001). A minimum required factor of safety of 1.3 was used in our analysis, with factor of safety defined as CRR/CSR. As required, our analysis assumes that the design earthquake would occur while the groundwater is at its estimated historically highest level. In the SPT method, soil resistance to liquefaction is estimated based on several factors, including SPT sampling blow counts normalized and corrected for several factors including fines content, and overburden pressure. Soil plasticity and moisture content are also considered in an evaluation of liquefaction. Parameters utilized in our analysis include

Standard Penetration Test (SPT) results from the borings, visual descriptions of soil samples retrieved, and geotechnical laboratory test results.

Due to relatively dense nature of the underlying soils, and the presence of cohesive fine-grained soils (silts and clays) which were screened for liquefaction susceptibility (Bray and Sancio, 2006), the underlying subsurface soils are **not** considered susceptible to liquefaction when considering a design historic high groundwater depth of 20 feet bgs and corresponding peak ground acceleration.

2.5.2 Lateral Spreading: Lateral spreading is unlikely to occur at the site due to the lack of liquefaction potential and lack of significant topographic relief at and around this site.

2.5.3 Seismically Induced Settlement: During a strong seismic event, non-liquefaction, seismically induced settlement can occur within loose and dry granular soils. Settlement caused by ground shaking is often unevenly distributed, which can result in differential settlement. Loose fill soils are typically highly susceptible to seismically induced settlement. Undocumented fill soils under the proposed building footprint are recommended (discussed later in this report) to be overexcavated and recompacted to reduce dynamic settlement concerns.

We have performed analyses to estimate the potential for seismically induced settlement using the method of Tokimatsu and Seed, and based on Martin and Lew (1999), considering the maximum considered earthquake (MCE) peak ground acceleration (PGA_M). Design/historic high groundwater levels of 20 feet below ground surface were used in the analysis. Based on our analysis, a potential for approximately 0.1 inch of seismic settlement is estimated at the site. Results of our seismic settlement analysis is presented in Appendix C.

If the potential differential settlement is estimated as half of the total seismic settlement over a horizontal distance of 30 feet, this would result in a maximum differential settlement of under 0.1 inch in 30 feet, or angular distortion of 0.00014L. This would be within the differential settlement threshold of 0.002L for structures of Risk Category IV, as listed in Table 12.13-3 of ASCE 7-16. The structural engineer should determine Structure Type and Risk Category and evaluate whether the differential settlement estimates described above are tolerable. A copy of ASCE 7-16 Table 12.13-3 is provided as follows for

reference.

Table 12.13-3 Differential Settlement Threshold

Structure Type	Risk Category		
	I or II	III	IV
Single-story structures with concrete or masonry wall systems	0.0075L	0.005L	0.002L
Other single-story structures	0.015L	0.010L	0.002L
Multistory structures with concrete or masonry wall systems	0.005L	0.003L	0.002L
Other multistory structures	0.010L	0.006L	0.002L

2.5.4 Slope Instability and Landslides: Seismically induced landslides and other slope failures are common occurrences during or soon after earthquakes. The site has been mapped by the State to **not** be within a landslide hazard zone based on our review of Earthquake Zones of Required Investigations for the Newport Beach Quadrangle (CGS, 1998). Considering the site and vicinity are relatively flat, the potential for seismically induced landslide activity is less than significant.

2.5.5 Earthquake-Induced Seiches and Tsunamis: Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Tsunamis are predominately ocean waves generated by undersea large magnitude fault displacement or major ground movement.

The site is located approximately 5 miles inland from the Pacific Ocean and is mapped outside of a tsunami hazard area as delineated by the State of California (CGS, 2021). There are no large nearby enclosed bodies of water in relation to the project site. Thus, the risk of seiches and tsunamis affecting the site is considered low.

2.5.6 Earthquake-Induced Inundation: This inundation hazard is flooding caused by failure of dams or other water-retaining structures as a result of earthquakes. Figure 7, *Dam Breach Inundation Map*, shows the subject **not** mapped within a dam breach inundation zone. Based on our review of available data, the potential for an earthquake induced inundation event is considered low.

2.6 **Storm-Induced Flood Hazard**

As depicted on Figure 6, *Flood Hazard Zone Map*, the site is mapped outside of a “100-year” flood zone; however, the northernmost portion of the site **is** mapped within a 0.2% Annual Flood Hazards zone also referred to as a “500-year” flood zone, as defined by the Federal Emergency Management Agency’s (FEMA’s) Flood Insurance Rate Map (FIRM). Based on our review FEMA’s FIRM map number 06059C02675 J (FEMA 2009) the site is mapped within Zone X “Other Flood Areas” which indicates the site is an area of 0.2% annual chance flood; area of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile and protected by levees from 1% annual chance flood. This corresponds to the nearby Santa Ana Delhi Channel which is located approximately 1,900 feet east of the project site. As such, the risk of flood hazards is considered minor, but the potential risk should be considered during the design of the proposed fire station.

2.7 **Infiltration Testing**

Infiltration testing was conducted within two of our borings onsite (LB-3/IT-1 and LB-4/IT-2) to estimate the infiltration characteristics of the onsite soils at the depths and locations tested. Infiltration testing was conducted with bottom test zone depths of approximately 15 feet bgs within boring IT-1 and 10 feet bgs within boring IT-2.

Borehole infiltration tests are useful for field measurements of soil infiltration rates, and are suited for testing when the design depth of the basin or chamber is deeper than current existing grades. It should be noted that this is a clean-water, small-scale test, and that correction factors need to be applied. A test consists of excavating a boring to the depth of the test (or deeper as long as it is partially backfilled with soil and a bentonite plug with a thin soil covering is placed just below the design test elevation). A layer of clean sand or gravel is then placed in the boring bottom to temporarily support a perforated well casing pipe system. Once the well casing pipe has been installed, coarse sand or gravel is poured in the annular space outside of the well casing within the test zone to prevent the boring from caving/collapsing or spalling when water is added. Water is added into the boring to an initial height. As water infiltrates into the soils, measurements are taken of the height of the water column at equally timed intervals (known as falling head test). We also conducted a constant water head by adding water to the borings as water infiltrated into the soil, while maintaining a relatively constant water head in the boring. The incremental infiltration rate as measured during

intervals of the test was defined as the incremental flow rate of water infiltrated, divided by the surface area of the infiltration interface. Well permeameter tests were conducted based on USBR 7300-89 method and in general accordance with Orange County guidelines.

Raw Infiltration rates for the well permeameter test yielded a rate of 26 inches/hour within Boring TI-2; however, confining fine grained soil layers (silts and clay) were encountered at depths as shallow as 12.5 feet bgs within the immediate area and as shown within our borings logs conducted at the site. Results of infiltration testing are provided in Appendix A. Further discussion of infiltration testing and related recommendations are included in Section 3.12.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 **Conclusions**

This site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone for surface fault rupture. However, as is the case for most of southern California, the most significant geotechnical issue at the site is related to the potential for strong seismic shaking. Historic groundwater levels have been estimated to be on the order of 20 feet below the surface based on the Seismic Hazard Report for the Anaheim and Newport Beach 7.5-Minute Quadrangle Report (CGS, 1997). Based on our analysis and the relatively dense nature of the underlying soils, the potential for liquefaction and seismic induced settlement is considered low at this site. The northern portion of the site is mapped within a 500-year flood zone and special consideration of this occurrence should be taken into consideration during design of the project. Recommendations for design and construction of proposed improvements are provided in the following sections.

The recommendations below are based upon the exhibited geotechnical engineering properties of the soils and their anticipated response both during and after construction. These recommendations are also based upon proper field observation and testing during construction. The project geotechnical engineer should be notified of suspected variances in field conditions to evaluate the effect upon the recommendations presented herein. These recommendations are considered minimal and may be superseded by more restrictive requirements of the civil and structural engineers, the County of Orange, and other governing agencies.

3.2 **Earthwork**

Project earthwork is expected to include overexcavation and recompaction of undocumented fill soils, and partial removals of onsite alluvial soils, below the proposed new building footprint as described in the following subsections:

- 3.2.1 Earthwork Observation and Testing:** Leighton should observe and test all grading and earthwork to check that the site has been properly prepared, to assess that selected fill materials are satisfactory, and to evaluate that placement and compaction of fills has been performed in accordance with our

recommendations and the project specifications. Any imported soil or aggregate material to be evaluated for its suitability as onsite fill material should be submitted to a Leighton geotechnical laboratory at least two working days in advance of earth material placement and compaction. Project plans and specifications should incorporate recommendations contained in the text of this report.

Variations in site conditions are possible and may be encountered during construction. To confirm correlation between soil data obtained during our field and laboratory testing and actual subsurface conditions encountered during construction, and to observe conformance with approved plans and specifications, we should be retained to perform continuous or intermittent review during earthwork, excavation, and foundation construction phases. Conclusions and recommendations presented in this report are contingent upon construction geotechnical observation services.

3.2.2 Site Preparation: Prior to construction, the site should be cleared of vegetation, trash and debris, which should be disposed of offsite. Any underground obstructions should be removed. Resulting cavities should be properly backfilled and compacted. Efforts should be made to locate existing utility lines. Those lines should be removed or rerouted if they interfere with the proposed construction, and the resulting cavities should be properly backfilled and compacted. Unsuitable deposits and undocumented fill should be excavated and removed from the proposed building footprints prior to fill placement. Removal of these unsuitable deposits and undocumented fill should be as recommended by Leighton Consulting during grading and further evaluated based on the foundation system.

Based on encountered soil conditions, we recommend that all existing fill to be completely removed, which were found to be generally 3 to 5 feet thick in our exploratory borings, but locally thicker undocumented fills are expected to be exposed during grading. Furthermore, potentially compressible native soils are recommended to be excavated below proposed building footprints to at least 3 feet below the bottoms of proposed footings or at least 5 feet below existing grade, whichever is deeper. Overexcavation bottoms should be evaluated by Leighton, and localized deeper removals may be recommended during grading based on exposed conditions.

Where possible, overexcavation bottoms should extend horizontally a distance beyond the outside edges of proposed building perimeter footings equal to the depth of excavation below finish grade or at least 5 feet horizontally, whichever is greater. Where this is not achievable, overexcavation should be reviewed on a case-by-case basis. Overexcavation should encompass the whole new building footprint including attached columns.

Areas outside proposed building pads, planned for asphalt and/or concrete pavement, should be overexcavated to a minimum depth of 24 inches below existing or finish grade, or 12 inches below proposed pavement sections; whichever is deeper.

Resulting removal excavation bottom surfaces should be observed by Leighton prior to placement of any backfill or new construction. It is essential that all existing fill soils be excavated from the proposed building footprints, regardless of depth. After overexcavation is completed and prior to fill placement, exposed surfaces should be scarified to a minimum depth of 6 inches, moisture conditioned to 3 percentage points above optimum moisture content, and recompact to a minimum 90 percent relative compaction as determined by ASTM D1557 standard test method (modified Proctor compaction curve).

3.2.3 Fill Placement and Compaction: Onsite soils free of organics and debris are suitable for use as compacted structural fill provided it is also free of oversized material (greater than 8 inches in its largest dimension). However, any soil to be placed as fill, whether onsite or imported material, should be first viewed by Leighton and then tested if and as necessary, prior to approval for use as compacted fill. All structural fill should be free of hazardous materials.

All fill soil should be placed in thin, loose lifts, moisture-conditioned, as necessary, to at least 3 percentage points above optimum moisture content and compacted to a minimum 90% relative compaction as determined by ASTM D1557 standard test method (modified Proctor compaction curve) within the building footprint. Aggregate base for pavement sections should be compacted to a minimum of 95% relative compaction.

No debris or oversize cobbles were observed at the site during our exploration. If oversize material and debris are encountered during grading or during demolition of the existing fire station building and associated features onsite, it

should be removed from soils prior to placement as compacted fill.

3.2.4 Shrinkage or Bulking: The change in volume of excavated and recompacted soil varies according to soil type and location. This volume change is represented as a percentage increase (bulking) or decrease (shrinkage) in volume of fill after removal and recompaction. Subsidence occurs as in-place soil (e.g., natural ground) is moisture-conditioned and densified to receive fill, such as in processing an overexcavation bottom. Subsidence is in addition to shrinkage due to recompaction of fill soil. Based on our laboratory test results for the underlying soils at the site we estimate the following earth volume changes will occur during grading:

Shrinkage and Subsidence	
Shrinkage	Approximately 3 +/- 5 percent
Subsidence (overexcavation bottom processing)	Approximately 0.1 foot

The level of fill compaction, variations in the dry density of the existing soils and other factors influence the amount of volume change. Some adjustments to earthwork volume should be anticipated during grading of the site.

3.3 **Seismic Design Parameters**

The site will experience strong ground shaking after the proposed project is developed resulting from an earthquake occurring along one or more of the major active or potentially active faults in southern California. Accordingly, the project should be designed in accordance with all applicable current codes and standards utilizing the appropriate seismic design parameters to reduce seismic risk as defined by California Geological Survey (CGS) Chapter 2 of Special Publication 117a (CGS, 2008). Through compliance with these regulatory requirements and the utilization of appropriate seismic design parameters selected by the design professionals, potential effects relating to seismic shaking can be reduced.

The following parameters should be considered for design under the 2022 CBC:

Table 1 . 2022 CBC Site-Specific Seismic Parameters

2022 CBC Parameters (CBC or ASCE 7-16 reference)	Value 2022 CBC
Site Latitude and Longitude: 33.6806, -117.8899	
Site Class Definition (1613.2.2, ASCE 7-16 Ch 20)	D**
Mapped Spectral Response Acceleration at 0.2s Period (1613.2.1), S_s	1.301 g
Mapped Spectral Response Acceleration at 1s Period (1613.2.1), S_1	0.466g
Short Period Site Coefficient at 0.2s Period (T1613.2.3(1)), F_a	1.000
Long Period Site Coefficient at 1s Period (T1613.2.3(2)), F_v	1.834*
Adjusted Spectral Response Acceleration at 0.2s Period (1613.2.3), S_{MS}	1.301 g
Adjusted Spectral Response Acceleration at 1s Period (1613.2.3), S_{M1}	0.855* g
Design Spectral Response Acceleration at 0.2s Period (1613.2.4), S_{DS}	0.867 g
Design Spectral Response Acceleration at 1s Period (1613.2.4), S_{D1}	0.570* g
Mapped MCE_G peak ground acceleration (11.8.3.2, Fig 22-9 to 13), PGA	0.558 g
Site Coefficient for Mapped MCE_G PGA (11.8.3.2), F_{PGA}	1.100
Site-Modified Peak Ground Acceleration (1803.5.12; 11.8.3.2), PGA_M	0.614 g

* See Section 11.4.8 of ASCE 7-16. A site-specific ground motion hazard analysis in accordance with Section 21.2 of ASCE 7-16 is required for this site. **Per Supplement 3 to ASCE 7-16, a site-specific ground motion hazard analysis is not required where the value of the parameters S_{M1} and S_{D1} in the table are increased by 50%.**

** Site Class D, and all of the resulting parameters in this table, may only be used for structures without seismic isolation or seismic damping systems.

A Site Class analysis is included in Appendix C in accordance with ASCE 7-16 Chapter 20. Subsurface data below 50 feet was conservatively estimated using Standard Penetration Test (SPT) blowcounts from our deepest boring. Hazard deaggregation was estimated using the USGS Interactive Deaggregations utility. The results of this analysis indicate that the predominant modal earthquake has a magnitude of approximately 7.69 (M_W) at a distance on the order of 6.58 kilometers for the Maximum Considered Earthquake (2% probability of exceedance in 50 years).

3.4 Foundations

Based on our exploration and our experience in the region, onsite soils exposed at pad grade are anticipated to exhibit a low expansive potential. As such, we recommend that the proposed structures be supported on conventional shallow

spread or strip footings foundation system in accordance with the California Building Code (CBC). Anticipated foundation loads were not available during preparation of this report. We assumed maximum column dead loads up to ($\leq$) 50 kips and wall loads of 3 kips per lineal foot for our preliminary foundation recommendations. Overexcavation and recompaction of footing subgrade soils should be performed as detailed in Section 3.2 of this report. Shallow foundation recommendations are provided in the following section.

3.4.1 Minimum Embedment and Width

Based on our preliminary investigation, footings should have a minimum embedment per code requirements, with a minimum width of 24 and 12 inches for isolated and continuous footings, respectively

3.4.2 Allowable Bearing

An allowable bearing pressure of 2,000 pounds-per-square-foot (psf) may be used, based on an assumed embedment depth of 18 inches and minimum width described above. This allowable bearing value may be increased by 250 psf per foot increase in depth or width to a maximum allowable bearing pressure of 3,000 psf. If higher bearing pressures are required, this should be reviewed on a case-by-case basis and may include additional overexcavation and/or soil reinforcement. These allowable bearing pressures are for total dead load and sustained live loads. Footing reinforcement should be designed by the structural engineer.

3.4.3 Lateral Load Resistance

Soil resistance available to withstand lateral loads on a shallow foundation is a function of the frictional resistance along the base of the footing and the passive resistance that may develop as the face of the structure tends to move into the soil. The frictional resistance between the base of the foundation and the subgrade soil may be computed using a coefficient of friction of 0.30. The passive resistance may be computed using an allowable equivalent fluid pressure of 240 pounds per cubic foot (pcf), assuming there is constant contact between the footing and undisturbed soil. The coefficient of friction and passive resistance may be combined without further reduction.

3.4.4 Increase in Bearing and Friction – Short Duration Loads

The allowable bearing pressure and coefficient of friction values may be increased by one-third when considering loads of short duration, such as those imposed by wind and seismic forces.

3.4.5 Settlement Estimates

The recommended allowable bearing pressure is generally based on a total allowable, post-construction static settlement of 1 inch. Differential settlement due to static loading is estimated at ½ inch over a horizontal distance of 30 feet. Since settlement is a function of footing sustained load, size and contact bearing pressure, differential settlement can be expected between adjacent columns or walls where a large differential loading condition exists.

3.5 Concrete Slab-On-Grade

Concrete slabs-on-grade should be designed by the structural engineer in accordance with 2022 CBC requirements for soil with a low expansion potential. More stringent requirements may be required by the structural engineer and/or architect; however, slabs-on-grade should have the following minimum recommended components:

- **Subgrade:** Slab-on-grade subgrade soil should be moisture conditioned to or within 3% over optimum moisture content, to a minimum depth of 24 inches within building footprints, and compacted to 95% of the modified Proctor (ASTM D1557) laboratory maximum density prior to placing either a moisture barrier, steel and/or concrete.
- **Moisture Barrier:** A moisture barrier consisting of at least 15-mil-thick Stego-wrap vapor barriers (see: http://www.stegoindustries.com/products/stego_wrap_vapor_barrier.php), or equivalent, should then be placed below slabs where moisture-sensitive floor coverings or equipment will be placed.
- **Reinforced Concrete:** A conventionally reinforced concrete slab-on-grade with a thickness of at least 4 inches should be placed in pedestrian areas without heavy loads. Reinforcing steel should be designed by the structural engineer, but as a minimum should be No. 4 rebar placed at 18 inches on-center, each direction (perpendicularly), mid-depth in the slab. A modulus of subgrade reaction (k) as a linear spring constant, of 90 pounds per square inch per inch deflection (pci) can be used for design of heavily loaded slabs-on-grade, assuming a linear response up to deflections on the order of ¾ inch.

- **Slab-On-Grade Control Joints:** Slab-on-grade crack control joint locations and spacing should be designed by the project Structural Engineer (SE). We suggest control joints of 12 feet on center. Control joints should form square panels.

Minor cracking of the concrete as it cures, due to drying and shrinkage, is normal and should be expected. However, cracking is often aggravated by a high water/cement ratio, high concrete temperature at the time of placement, small nominal aggregate size, and rapid moisture loss due to hot, dry, and/or windy weather conditions during placement and curing. Cracking due to temperature and moisture fluctuations can also be expected. Low slump concrete can reduce the potential for shrinkage cracking. Additionally, our experience indicates that reinforcement in slabs and foundations can generally reduce the potential for concrete cracking. The structural engineer should consider these components in slab design and specifications.

Moisture retarders can reduce, but not eliminate moisture vapor rise from the underlying soils up through the slab. Floor covering manufacturers should be consulted for specific recommendations.

Leighton does not practice in the field of moisture vapor transmission evaluation, since this is not specifically a geotechnical issue. Therefore, we recommend that a qualified person, such as the flooring subcontractor and/or structural engineer, be consulted with to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. That person should provide recommendations for mitigation of potential adverse impact of moisture vapor transmission on various components of the structures as deemed appropriate.

3.6 **Sulfate Attack and Ferrous Corrosion Protection**

- 3.6.1 Sulfate Exposure:** Sulfate ions in the soil can lower the soil resistivity and can be highly aggressive to Portland cement concrete by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. This reaction is accompanied by expansion and eventual disruption of the concrete matrix. A potentially high sulfate content could also cause corrosion of reinforcing steel in concrete. Section 1904A of the 2022 California Building Code (CBC) defers to the American Concrete Institute's (ACI's) ACI 318-19 for concrete durability requirements. Table 19.3.1.1 of ACI 318-19 lists "*Exposure categories and classes*," including sulfate exposure as follows:

Table 2. Sulfate Concentration and Exposure

Soluble Sulfate in Water (parts-per-million)	Water-Soluble Sulfate (SO ₄) in soil (percentage by weight)	ACI 318-19 Sulfate Class
0-150	0.00 - 0.10	S0 (negligible)
150-1,500	0.10 - 0.20	S1 (moderate*)
1,500-10,000	0.20 - 2.00	S2 (severe)
>10,000	>2.00	S3 (very severe)

*or seawater

3.6.2 Ferrous Corrosivity: Many factors can modify corrosion potential of soil including soil moisture content, resistivity, permeability and pH, as well as chloride and sulfate concentration. In general, soil resistivity, which is a measure of how easily electrical current flows through soils, is the most influential factor. Based on the findings of studies presented in ASTM STP 1013 titled “*Effects of Soil Characteristics on Corrosion*” (February 1989), the approximate relationship between soil resistivity and soil corrosiveness was developed as follows:

Table 3. Soil Resistivity and Soil Corrosivity

Soil Resistivity (ohm-cm)	Classification of Soil Corrosiveness
0 to 900	Very Severely Corrosive
900 to 2,300	Severely Corrosive
2,300 to 5,000	Moderately Corrosive
5,000 to 10,000	Mildly Corrosive
10,000 to >100,000	Very Mildly Corrosive

Acidity is an important factor of soil corrosivity. The lower the pH (the more acidic the environment), the higher the soil corrosivity will be with respect to buried metallic structures and utilities. As soil pH increases above 7 (the neutral value), the soil is increasingly more alkaline and less corrosive to buried steel structures, due to protective surface films, which form on steel in high pH environments. A pH between 5 and 8.5 is generally considered relatively passive from a corrosion standpoint. Chloride and sulfate ion concentrations, and pH appear to play secondary roles in modifying corrosion potential. High chloride levels tend to reduce soil resistivity and break down otherwise protective surface deposits, which can result in corrosion of buried steel or reinforced concrete structures.

3.6.3 Corrosivity Estimates: To evaluate corrosion potential of soils sampled from this site, we tested a bulk soil sample for soluble sulfate content, soluble chloride content, pH and resistivity. Results of these tests are summarized below:

Table 4. Results of Corrosivity Testing

Locations	Sample Depth (feet)	Sulfate (mg/kg)	Chloride (mg/kg)	pH	Minimum Resistivity (ohm-cm)
Boring LB-2	0 - 5	99	120	9.1	1,620

Note: mg/kg = milligrams per kilogram, or parts-per-million (ppm)

These results are discussed as follows:

- Sulfate Exposure:** Based on recovered near surface soils and Table 19.3.1.1 of ACI 318-19, in our opinion, sulfate exposure should be considered “negligible” with an Exposure Class S0 for soils sampled at the site. Based on Table 19.3.2.1 of ACI 318-19, for this Exposure Category S0, there would be no restrictions on cement type (“cementitious material”) nor water/cement ratio, and an f_c' (28-day compressive strength) of at least 2,500 pounds per square inch (psi) is required at a minimum for structural concrete.
- Ferrous Corrosivity:** As shown above, minimum soil resistivity of 1,620 ohm-centimeters was measured in our laboratory test. In our opinion, it appears for site soils that corrosion potential to buried steel may be characterized as “severely corrosive” at the site. Ferrous pipe buried in moist to wet site earth materials may be replaced by high-density polyethylene (HDPE) or other non-ferrous pipe when possible. Or ferrous pipe may be protected by polyethylene bags, tap or coatings, di-electric fittings or other means to separate the pipe from on-site earth materials. A corrosion engineer may also be consulted to further evaluation for more detailed recommendations relating to onsite soil corrosion characteristics.

3.7 Pavement Section Design

Based on design procedures outlined in the 2017 Caltrans *Highway Design Manual* and a design R-value of less than 5 for onsite subgrade soils based on laboratory testing, preliminary flexible pavement sections were calculated for the Traffic Indices (TIs) tabulated, and are listed below:

Table 5. Hot Mixed Asphalt (HMA) Pavement Sections

Assumed Traffic Index	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
5.0 (automobile parking, driveways)	3.0	10.0
6.0 (truck traffic)	4.0	11.5
7.0 (roadways and heavy truck traffic)	6.0	12.0

For fire truck (60,000-pound “apparatus”) lanes, asphalt pavements designed for a TI=6.0 are recommended. However, note that undistributed apparatus outrigger loads could cause local asphalt pavement punching damage. When possible, outrigger loads should be distributed over asphalt pavements with planks and plywood. Otherwise, areas where outrigger loads are anticipated could be paved with 8-inch-thick concrete as described below.

Onsite clays are expected to have a low expansive potential, and R-value test on a near-surface sample was low ($R < 5$). A subgrade sample should be collected during grading to perform additional R-Value tests to verify pavement design. Alternatively, in order to reduce the pavement section thicknesses provided in the table above, the subgrade soils can be cement-treated. We recommend that additional samples be collected during construction for R-Value testing, and also to determine the ideal cement treatment ratio (typically on the order of 3 to 5 percent). The following table provides pavement sections for cement-treated subgrade.

Table 6. Hot Mixed Asphalt (HMA) Pavement Sections
Cement Treated Subgrade *

Assumed Traffic Index	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
5.0 (automobile parking, driveways)	3.0	5.5
6.0 (truck traffic)	3.5	7.5
7.0 (roadways and heavy truck traffic)	4.0	9.5

*subgrade treated with 3%-5% cement

Portland cement concrete (PCC) pavement sections were calculated in accordance with procedures developed by the Portland Cement Association. Concrete paving sections for three Traffic Indices (TIs) are presented below:

Table 7. Portland Cement Concrete Pavement Sections

Assumed Traffic Index	PC Concrete (inches)	Base Course (inches)
5.0 (automobile parking, driveways)	6	8
6.0 (roadways and truck traffic)	8	

We have assumed that this Portland cement concrete will have a compressive strength of at least 3,000 psi. Prior to placement of aggregate base, subgrade soils should be scarified to a minimum depth of 8 inches, moisture-conditioned, as necessary, and recompact to a minimum of 95 percent relative compaction, determined in accordance with ASTM D1557 modified Proctor laboratory maximum density. Aggregate base should be placed in thin lifts; moisture conditioned, as necessary, and compacted to a minimum of 95 percent relative compaction. Field observation and periodic testing, as needed during placement of base course materials, should be undertaken to ensure that requirements of current Caltrans' *Standard Specifications* and Special Provisions are fulfilled. Consideration should be given to reinforce concrete pavements where large outrigger point loads are anticipated.

Adequate drainage (both surface and subsurface) should be provided such that the subgrade soils and aggregate base materials are not allowed to become wet. All pavement construction should be performed in accordance with the current Caltrans *Standard Specifications* or *Standard Specifications for Public Works Construction* ("Greenbook"). Recommended structural pavement materials should conform to the specified provisions in the current Caltrans *Standard Specifications* including grading and quality requirements, shown below:

- **Asphalt Concrete (Hot Mixed Asphalt)** for pavement should be Type A and should conform to Section 39 of the *Standard Specifications*. Asphalt concrete specimens should be tested for surface abrasion in accordance with CT-360.
- **Portland Cement Concrete (PCC)** pavement should conform to Section 40 of the *Standard Specifications*. PCC pavement materials (pavement, structures, minor concrete) should conform to Section 90 of the *Standard Specifications*.
- **Class II Aggregate Base (AB)** should conform to Section 26 of the *Standard Specifications*.

Traffic Indices (TIs) used in our pavement design are considered reasonable values for typical parking lot areas, and should provide a pavement life of approximately 20 years with a normal amount of flexible pavement maintenance.

Irrigation adjacent to pavements, without a deep curb or other cutoff to separate landscaping from the paving, will result in premature pavement failure. Traffic parameters used for design were selected based on engineering judgment and not on information furnished to us such as an equivalent wheel-load analysis or a traffic study. The project Civil Engineer should confirm the TI assumptions.

- 3.8 Surface Drainage:** Pad drainage should be designed to collect and direct surface water away from structures to approved drainage facilities. Hardscape drains should be installed and drain to approved storm water disposal systems. Drainage patterns and drainpipes approved at the time of fine grading should be maintained throughout the life of proposed structures.

3.9 Retaining Wall Recommendations

The following retaining wall recommendations are included for design consideration of walls with a height less than 6 feet. We recommend that retaining walls be backfilled with very low expansive soil and constructed with a backdrain in accordance with the recommendations provided on Figure 8, *Retaining Wall Backfill and Subdrain Detail*. Using expansive soil as retaining wall backfill will result in higher lateral earth pressures exerted on the wall and are, therefore, not recommended. Retaining wall locations and configurations are unknown at the time of this report.

Table 8. Retaining Wall Design Parameters

Static Equivalent Fluid Pressure (pcf)	
Condition	Level Backfill
Active	45
At-Rest (drained, compacted-fill backfill)	65
Passive (ultimate)	230 (Max. 3,000 psf)

The above values do not contain an appreciable factor of safety, so the structural engineer should apply the applicable factors of safety and/or load factors during design.

Cantilever walls that are designed to yield at least $0.001H$, where H is equal to the wall height, may be designed using the active condition. Rigid walls and walls braced at the top should be designed using the at-rest condition.

Passive pressure is used to compute soil resistance to lateral structural movement. In addition, for sliding resistance, a frictional resistance coefficient of 0.35 may be used at the concrete and soil interface. The lateral passive resistance should be taken into account only if it is ensured that the soil providing passive resistance, embedded against the foundation elements, will remain intact with time. A soil unit weight of 120 pcf may be assumed for calculating the actual weight of the soil over the wall footing.

In addition to the above lateral forces due to retained earth, surcharge due to improvements, such as an adjacent structure or traffic loading, should be considered in the design of the retaining wall. Loads applied within a 1:1 projection from the surcharging structure on the stem of the wall should be considered in the design. A third of uniform vertical surcharge-loads should be applied at the surface as a horizontal pressure on cantilever (active) retaining walls, while half of uniform vertical surcharge-loads should be applied as a horizontal pressure on braced (at-rest) retaining walls. To account for automobile parking surcharge, we suggest that a uniform horizontal pressure of 100 psf (for restrained walls) or 70 psf (for cantilever walls) be added for design, where autos are parked within a horizontal distance behind the retaining wall less than the height of the retaining wall stem.

We recommend that the wall designs for walls 6 feet tall or taller be checked seismically using an *additive seismic* Equivalent Fluid Pressure (EFP) of 17 pcf, which is added to the EFP. The *additive seismic* EFP should be applied at the retained midpoint.

Conventional retaining wall footings should have a minimum width of 24 inches and a minimum embedment of 12 inches below the lowest adjacent grade. An allowable bearing pressure of 2,000 psf may be used for retaining wall footing design, based on the minimum footing width and depth. This bearing value may be increased by 250 psf per foot increase in width or depth to a maximum allowable bearing pressure of 3,000 psf.

3.10 Infiltration Recommendations

Based on our onsite observations, and infiltration test results summarized in the table below, reliance of infiltration into onsite near surface native soils is not considered feasible due to encountered fine grained soils (clays and silts) within the near surface soils and the mapped historical high groundwater table within the area.

Orange County Guidelines indicate that BMP system invert elevations need to have a minimum 10-foot vertical setback from historical groundwater elevations. As mentioned in Section 2.3, the historical high ground water level at the site is mapped to be approximately 20 feet bgs, resulting in an maximum allowable invert elevation of 10 feet bgs.

Although infiltration testing with a bottom depth of 10 feet bgs produced moderate rates for the test itself, soils with higher percent fines and fine-grained soils (silts and clays) were generally located above and below this very narrow test zone with favorable soils at depths ranging from 8 to 10 feet, causing a confining layer within neighboring borings. The very narrow clean sand layer (6% fines) was not encountered within any of our other borings onsite. It is likely that water infiltrated at depths of approximately 10 feet bgs through prolonged infiltration will tend to migrate laterally rather than vertically and produce lower infiltration values.

4.0 CONSTRUCTION CONSIDERATIONS

4.1 Trench Excavations

To protect workers entering excavations, all temporary excavations, including utility trenches, retaining wall excavations and other excavations should be performed in accordance with project plans, specifications and all OSHA and Cal-OSHA requirements, and the current edition of the California Construction Safety Orders.

No surcharge loads should be permitted within a horizontal distance equal to the height of cut or 5 feet, whichever is greater from the top of the slope, unless the cut is shored appropriately. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any adjacent existing site foundation should be properly shored to maintain support of the adjacent structures.

Contractors should be advised that fill soils should initially be considered Type C soils as defined in the California Construction Safety Orders. As indicated in Table B-1 of Article 6, Section 1541.1, Appendix B, of the California Construction Safety Orders, excavations less-than (<) 20 feet deep within Type C soils should be sloped back no steeper than 1½:1 (horizontal:vertical), where workers are to enter the excavation. This may be impractical near adjacent existing utilities and structures; so shoring may be required depending on trench locations. Stiff undisturbed native clays will stand steeper.

During construction, the soil conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor should be responsible for providing the "competent person" required by OSHA, standards to evaluate soil conditions. Close coordination between the competent person and the geotechnical engineer should be maintained to facilitate construction while providing safe excavations.

4.2 Temporary Shoring

Temporary cantilever shoring can be designed based on the active equivalent fluid pressure of 45 pounds-per-cubic-foot (pcf). If excavations are braced at the top and at specific depth intervals, then braced earth pressure may be approximated by a uniform rectangular soil pressure distribution. This uniform pressure

expressed in pounds-per-square-foot (psf), may be assumed to be 25 multiplied by H for design, where H is equal to the depth of the excavation being shored, in feet. These recommendations are valid only for trenches not exceeding 15 feet in depth at this site.

4.3 **Trench Backfill**

Utility trenches should be backfilled with compacted fill in accordance with Sections 306-1.2 and 306-1.3 of the *Standard Specifications for Public Works Construction* (SSPWC, “Greenbook”), 2024 Edition. Utility trenches may be backfilled with onsite material free of rubble, debris, organic and oversized material up to 3 inches in largest dimension. Prior to backfilling trenches, pipes should be bedded in and covered with either:

- (1) **Granular Bedding:** a uniform sand material with a Sand Equivalent (SE) greater-than- or-equal-to ($\geq$) 30, passing the No. 4 U.S. Standard Sieve (or as specified by the pipe manufacturer). Due to the possibility of shallow groundwater in select areas, sand bedding should not be jetted, but should be mechanically compacted in accordance with the Greenbook, latest edition.
- (2) **CLSM:** Controlled Low Strength Material (CLSM) conforming to Section 201-6 of the SPWC. CLSM bedding should be placed to 1-foot (0.3 m) over the top of the conduit and vibrated.

We recommend that open-graded crushed rock or similar material not be used as bedding material, unless special provisions are implemented to limit the migration of surrounding soil into the open-graded material, including surrounding the open-graded material with filter fabric (Mirafi 140N or equivalent), or mixing sand with the open-graded material. Pipe bedding should extend at least 4 inches below the pipeline invert and at least 12 inches over the top of the pipeline. The bedding and shading sand is recommended to be densified in place by vibratory, lightweight compaction equipment.

Trench backfill over the pipe bedding zone may consist of native and clean fill soils. All backfill should be placed in thin lifts (appropriate for the type of compaction equipment), moisture conditioned to slightly above optimum, and mechanically compacted to at least 90 percent of the laboratory derived maximum density as determined by ASTM Test Method D 1557.

4.4 Geotechnical Services During Construction

Our geotechnical recommendations provided in this report are based on information available at the time the report was prepared and may change as plans are developed. Additional geotechnical exploration, testing and/or analysis may be required based on final plans. Leighton Consulting, Inc. should review site grading, foundation, and shoring (if any) plans when available, to comment further on geotechnical aspects of this project and check to see general conformance of final project plans to recommendations presented in this report.

Leighton Consulting, Inc. should be retained to provide geotechnical observation and testing during excavation and all phases of earthwork. Our conclusions and recommendations should be reviewed and verified by us during construction and revised accordingly if geotechnical conditions encountered vary from our findings and interpretations. Geotechnical observation and testing should be provided:

- During all excavation,
- During installation of ground improvements
- During compaction of all fill materials,
- After excavation of all footings and prior to placement of concrete,
- During utility trench backfilling and compaction,
- During pavement subgrade and base preparation, and/or
- If and when any unusual geotechnical conditions are encountered.

5.0 LIMITATIONS

This report was necessarily based in part upon data obtained from a limited number of observances, site visits, soil samples, tests, analyses, histories of occurrences, spaced subsurface explorations and limited information on historical events and observations. Such information is necessarily incomplete. The nature of many sites is such that differing characteristics can be experienced within small distances and under various climatic conditions. Changes in subsurface conditions can and do occur over time. This exploration was performed with the understanding that this subject site is proposed for development as described in Section 1.2 of this report. Please also refer to Appendix E, *GBA's Important Information About This Geotechnical-Engineering Report*, presenting additional information and limitations regarding geotechnical engineering studies and reports.

Until reviewed and accepted by the reviewing government agency, this report may be subject to change. Changes may be required as part of the review process. Leighton Consulting, Inc. assumes no risk or liability for consequential damages that may arise due to design work progressing before this report is reviewed and accepted.

This report was prepared for PBK Architects based on their needs, directions and requirements at the time of our exploration, in accordance with generally accepted geotechnical engineering practices at this time in Orange County for public sites. This report is not authorized for use by, and is not to be relied upon by, any party except PBK Architects and their design and construction management team, with whom Leighton Consulting, Inc. has contracted for this work. Use of or reliance on this report by any other party is at that party's risk. Unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify Leighton Consulting, Inc. from and against any liability which may arise as a result of such use or reliance, regardless of any fault, negligence, and/or strict liability of Leighton Consulting, Inc.

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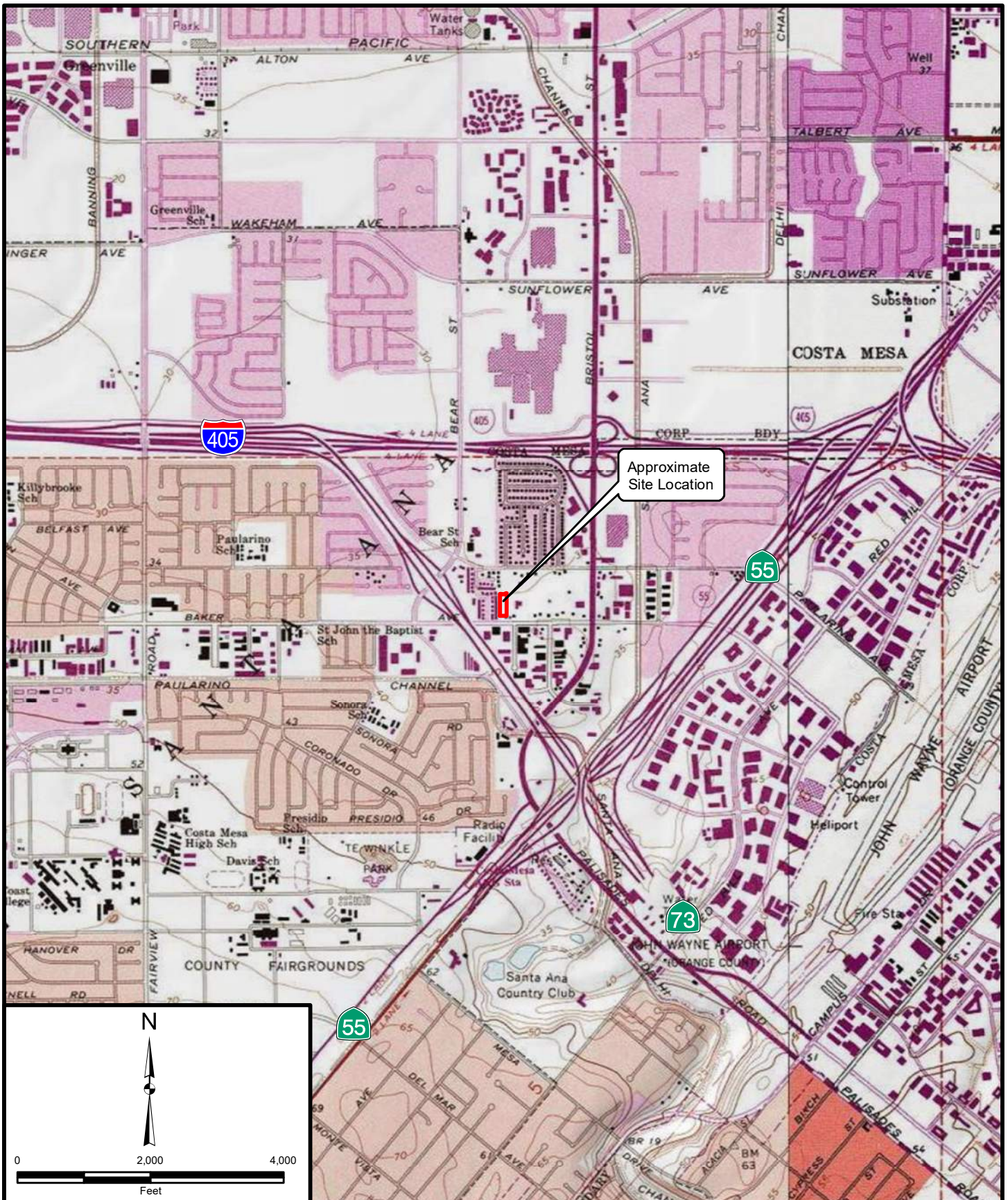
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Project: 24475	Eng/Geol: JT
Scale: 1" = 2,000'	Date: July 2024
Reference: Copyright:© 2013 National Geographic Society, i-cubed	

SITE LOCATION MAP

Proposed Costa Mesa Fire Station
No. 2 Replacement
800 Baker Street, Costa Mesa, California

FIGURE 1





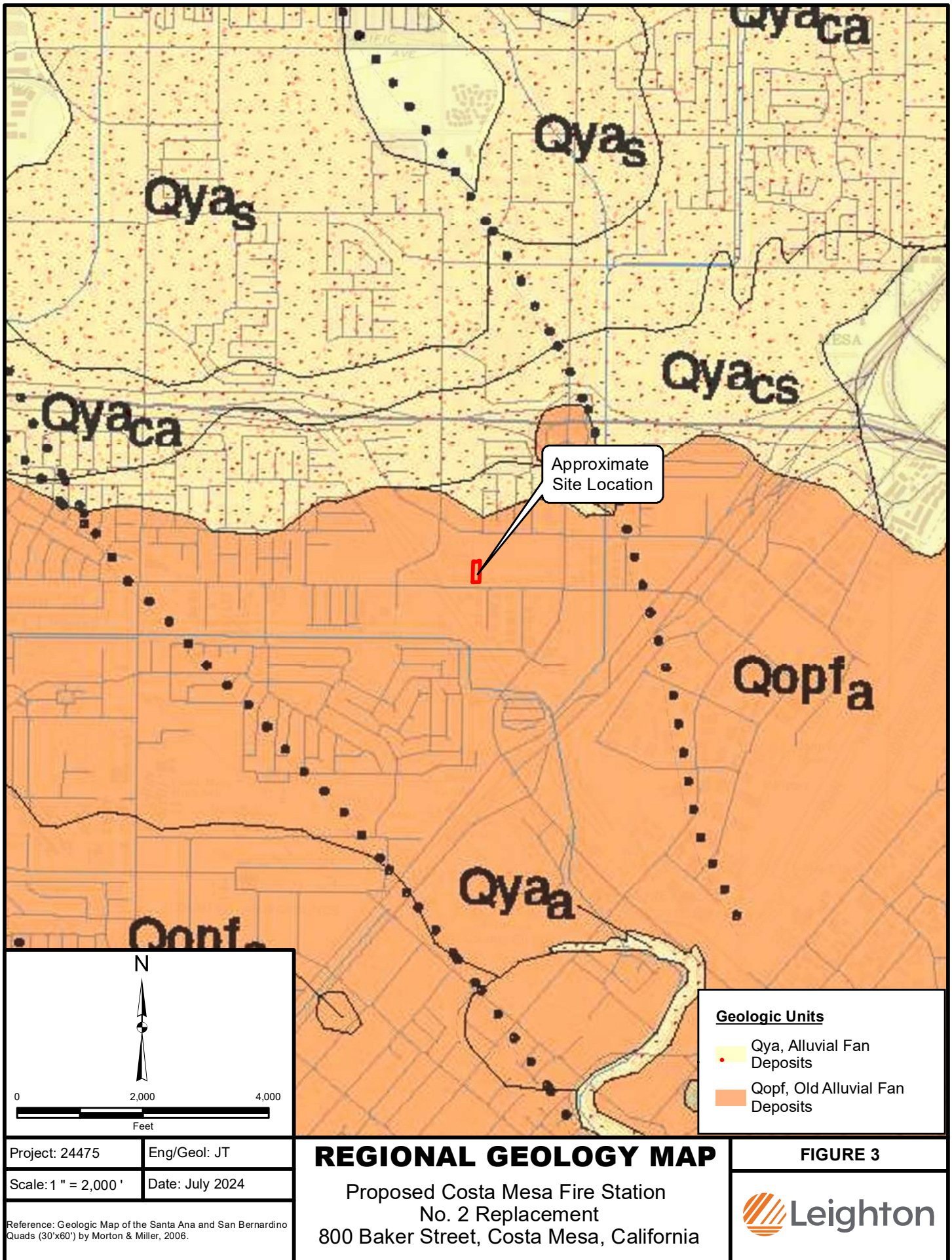
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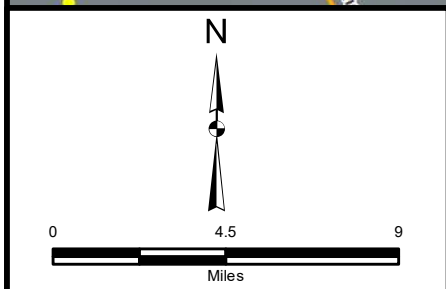
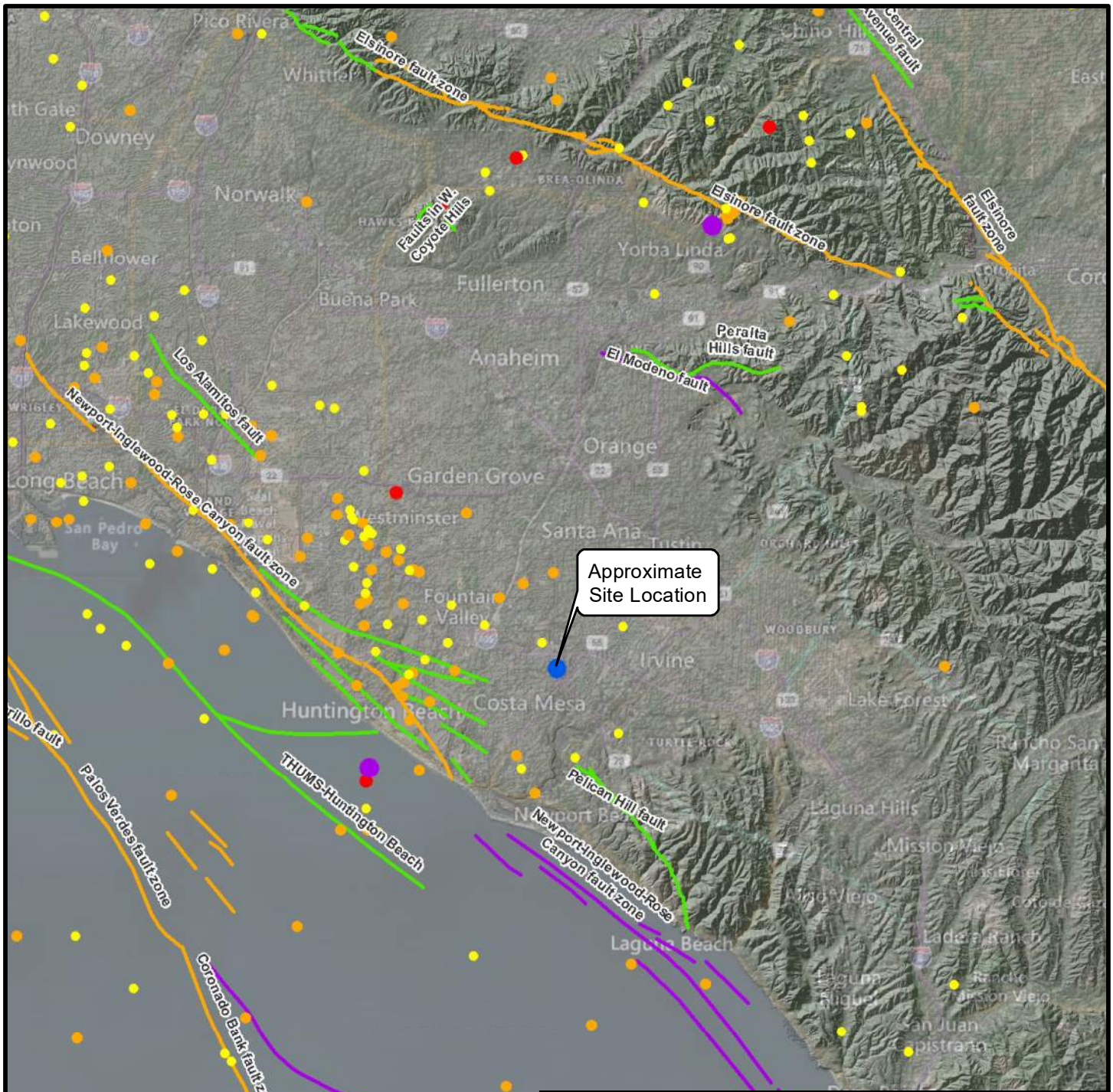
LB-4/IT-2
T.D. 10'
No GW

Approximate location of hollow-stem auger boring showing total depth (T.D.), groundwater condition, and depth to earth units and depth to groundwater (GW) in feet below existing ground surface

Approximate Building Footprint

Approximate Site Boundary





Legend

Fault activity

Recency of Movement

- Historic (<200 years)
- Holocene (<11,700 years)
- Late Quaternary (last 700,000 years)
- Quaternary (<1.6M years)

Historical Earthquakes ($\geq M3.5$)

- 3.5 - 3.99
- 4.0 - 4.99
- 5.0 - 5.99
- 6.0 - 6.99

Project: 24475

Eng/Geol: JT

Scale: 1" = 5 miles

Date: July 2024

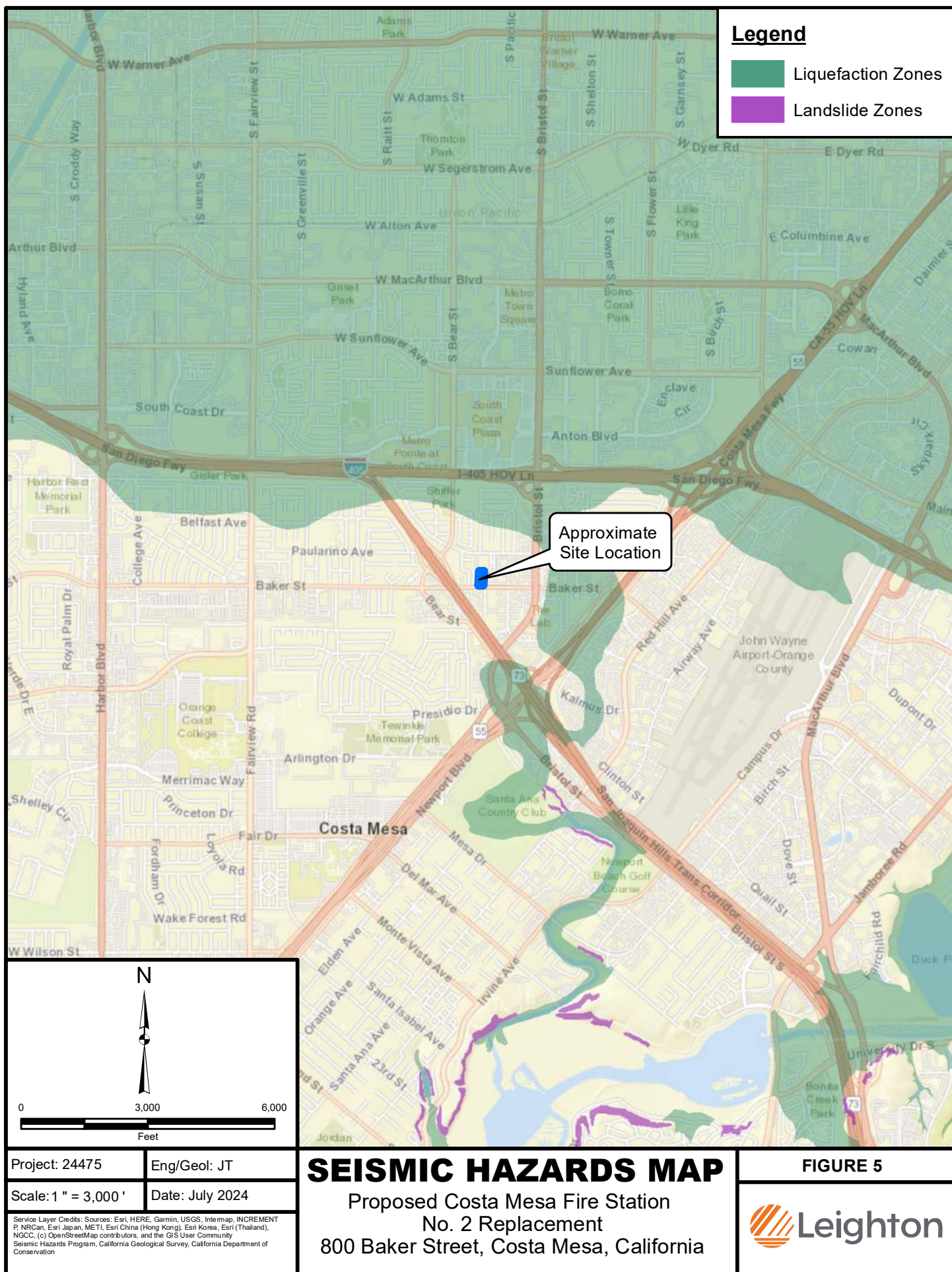
Basemap Reference: © 2024 Microsoft Corporation
Earthstar Geographics SIO © 2024 TomTom
Seismicity Data Reference: maps.conservation.ca.gov

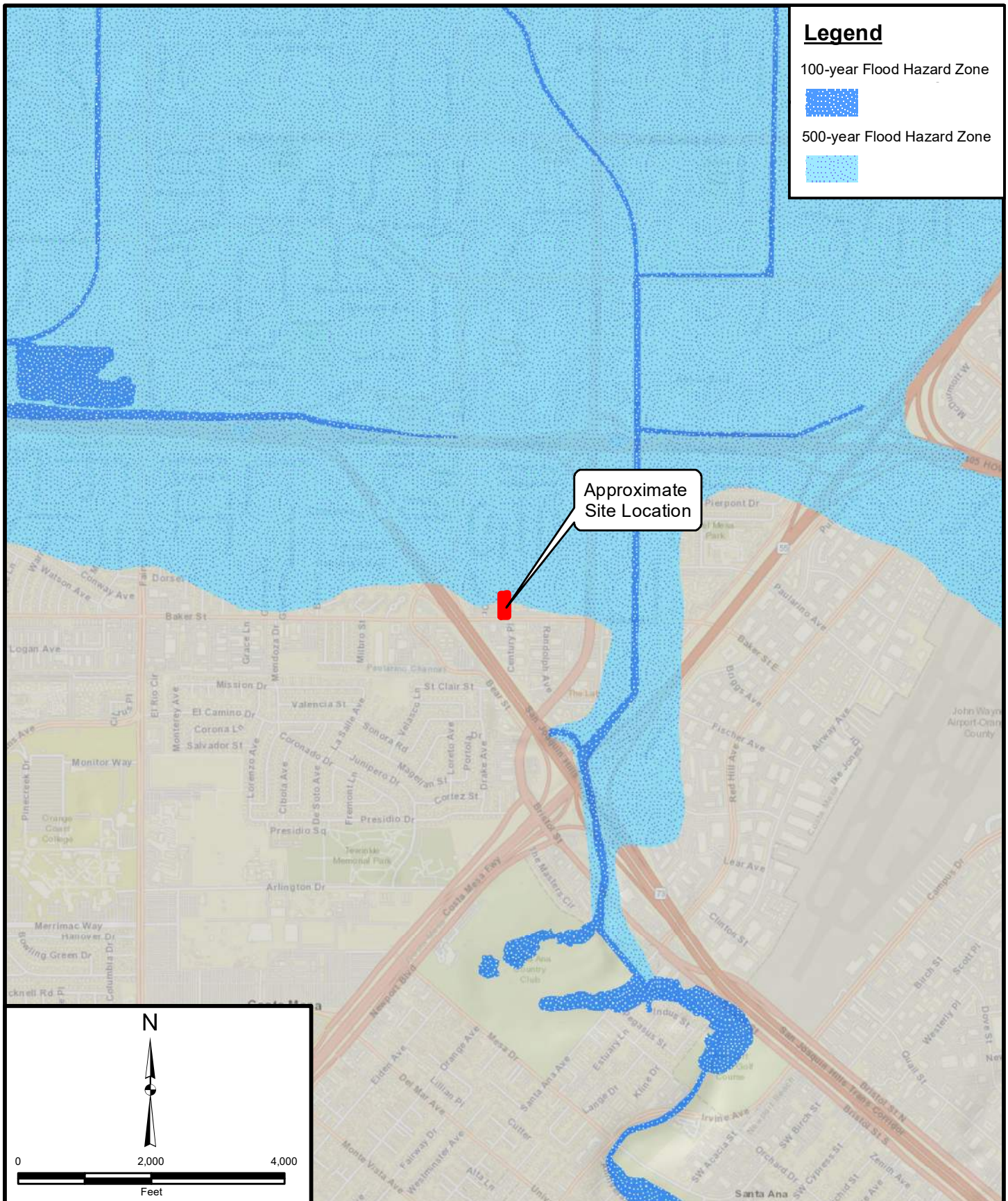
REGIONAL FAULT AND HISTORIC SEISMICITY MAP

Proposed Costa Mesa Fire Station
No. 2 Replacement
800 Baker Street, Costa Mesa, California

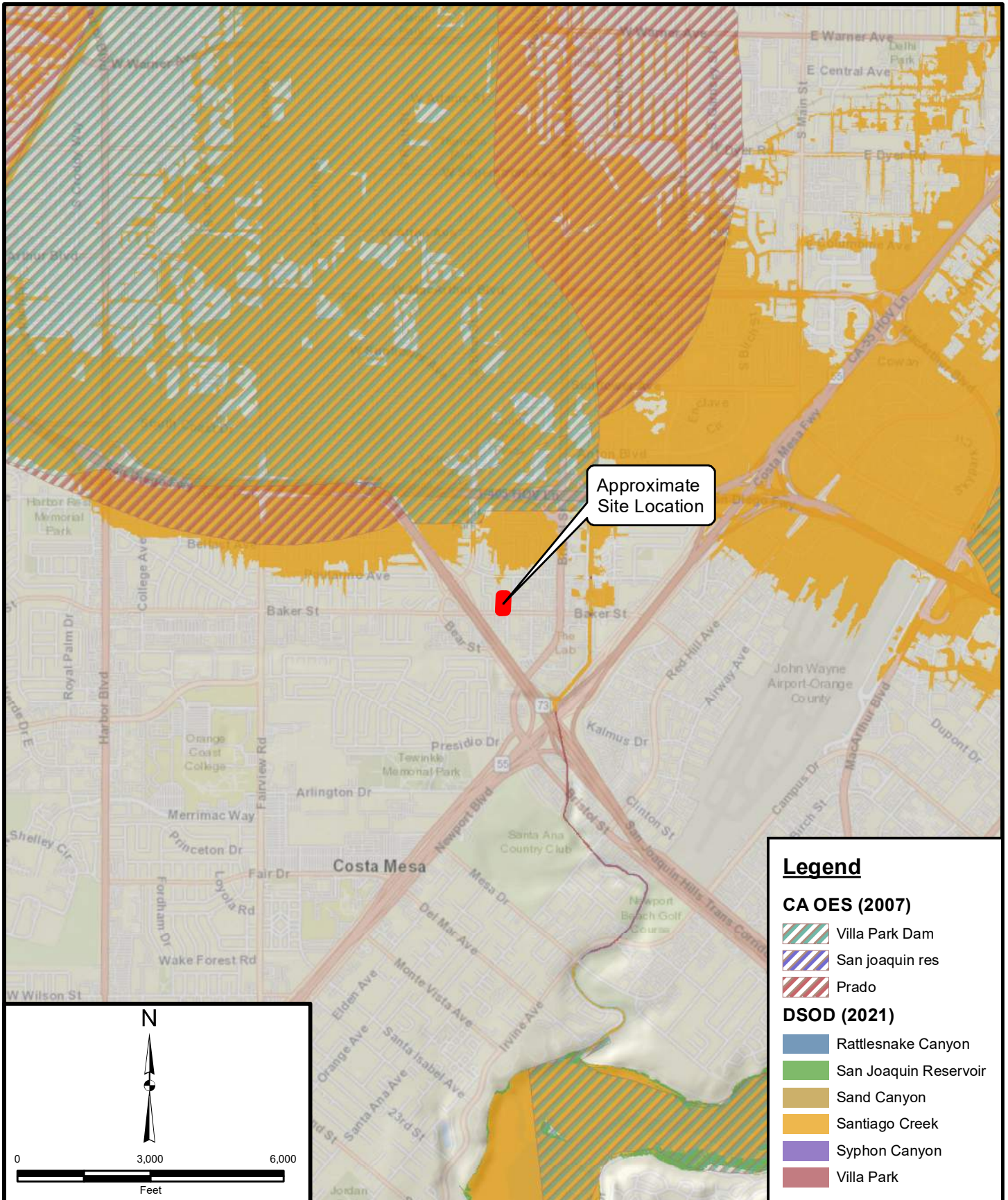
FIGURE 4







Project: 24475	Eng/Geol: JT	FLOOD HAZARD ZONE MAP	FIGURE 6
Scale: 1 " = 2,000 '	Date: July 2024		
Reference: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRcan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community FEMA (http://www.fema.gov/index.shtm), DWR (http://www.dwr.ca.gov)		Proposed Costa Mesa Fire Station No. 2 Replacement 800 Baker Street, Costa Mesa, California  Leighton	



Project: 24475	Eng/Geol: JT
Scale: 1" = 3,000'	Date: July 2024
Basemap Reference: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China Reference: Office of Emergency Services (2007), Dept of Safety of Dams (2021) National Inventory of Dams, Army Corps of Engrs (2021)	

DAM INUNDATION MAP

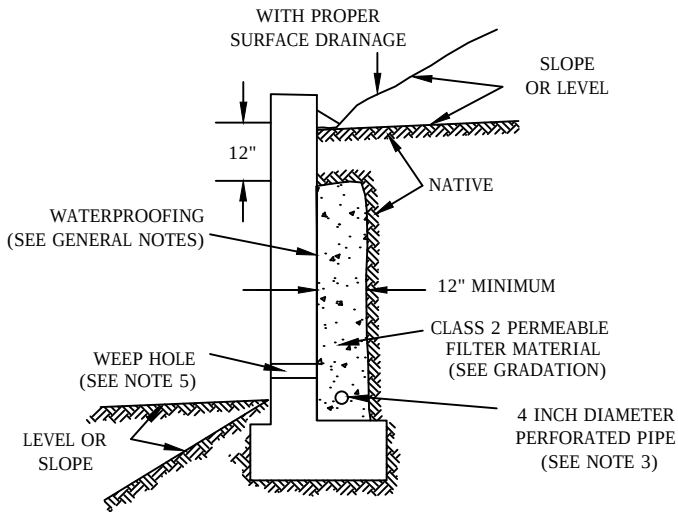
Proposed Costa Mesa Fire Station
 No. 2 Replacement
 800 Baker Street, Costa Mesa, California

FIGURE 7

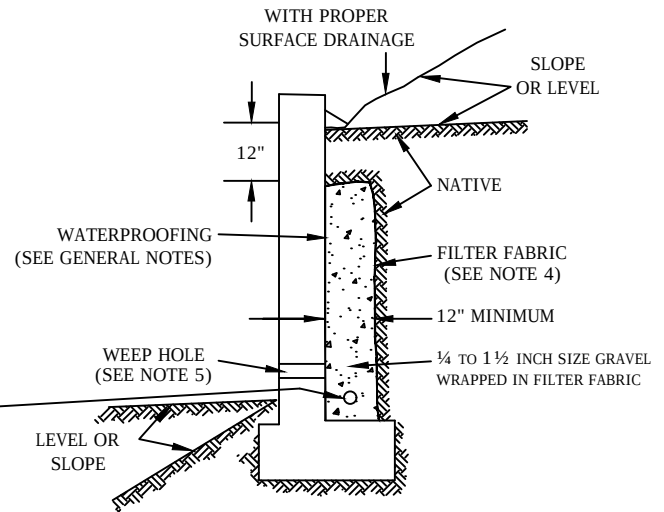


SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤ 50

OPTION 1: PIPE SURROUNDED WITH CLASS 2 PERMEABLE MATERIAL



OPTION 2: GRAVEL WRAPPED IN FILTER FABRIC



Class 2 Filter Permeable Material Gradation
Per Caltrans Specifications

Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

GENERAL NOTES:

- * Waterproofing should be provided where moisture nuisance problem through the wall is undesirable.
- * Water proofing of the walls is not under purview of the geotechnical engineer
- * All drains should have a gradient of 1 percent minimum
- * Outlet portion of the subdrain should have a 4-inch diameter solid pipe discharged into a suitable disposal area designed by the project engineer. The subdrain pipe should be accessible for maintenance (rodding)
- * Other subdrain backfill options are subject to the review by the geotechnical engineer and modification of design parameters.

Notes:

- 1) Sand should have a sand equivalent of 30 or greater and may be densified by water jetting.
- 2) 1 Cu. ft. per ft. of 1/4- to 1 1/2-inch size gravel wrapped in filter fabric
- 3) Pipe type should be ASTM D1527 Acrylonitrile Butadiene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Armco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down. Perforations should be 3/8 inch in diameter placed at the ends of a 120-degree arc in two rows at 3-inch on center (staggered)
- 4) Filter fabric should be Mirafi 140NC or approved equivalent.
- 5) Weephole should be 3-inch minimum diameter and provided at 10-foot maximum intervals. If exposure is permitted, weepholes should be located 12 inches above finished grade. If exposure is not permitted such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to be discharged through the curb face or equivalent should be provided. For a basement-type wall, a proper subdrain outlet system should be provided.
- 6) Retaining wall plans should be reviewed and approved by the geotechnical engineer.
- 7) Walls over six feet in height are subject to a special review by the geotechnical engineer and modifications to the above requirements.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL FOR WALLS 6 FEET OR LESS IN HEIGHT

WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤ 50



Figure 8

APPENDIX A

FIELD EXPLORATION

Our field exploration consisted of geologic reconnaissance and a subsurface exploration program consisting of four (4) geotechnical borings. These subsurface exploration locations are plotted on Figure 2, *Exploration Location Map*, and describe in more detail below:

Hollow Stem Auger Borings: On June 17, 2024, four (4) borings were drilled with a truck-mounted drill rig, logged and sampled to depths ranging from approximately 10 feet to 51.5 feet bgs. After sampling and logging, all borings were immediately backfilled with soil cuttings generated during drilling and asphalt cold patched. Encountered soils were continuously logged in the field by our representative and described in accordance with the Unified Soil Classification System (ASTM D 2488). Near surface bulk soil samples were collected from these borings. Boring logs are included as part of this appendix.

Subsurface Variations and Limitations: These attached subsurface exploration logs and related information depict subsurface conditions only at the approximate locations indicated and at the particular date designated on the logs. Subsurface conditions at other locations may differ from conditions occurring at these locations. Passage of time may result in altered subsurface conditions due to possible environmental changes. In addition, any stratification lines depicted on these logs represent an approximate boundary between soil types, but these transitions can be gradual.

GEOTECHNICAL BORING LOG LB-1

Project No. 038.0000024475
 Project PBK Costa Mesa FS No. 2 Replacement GE
 Drilling Co. 2R Drilling, Inc.
 Drilling Method Hollow Stem Auger - 140lb - Autohammer - 30" Drop
 Location See Figure 2 - Exploration Location Map

Date Drilled 6-17-24
 Logged By BTM
 Hole Diameter 8"
 Ground Elevation 39'
 Sampled By BTM

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION <i>This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.</i>	Type of Tests
	0	N S							Artificial Fill, undocumented (Afu) @Surface: 5-inches asphalt concrete over 5-inches base @10": SANDY CLAY, reddish brown, moist, mostly fine sand, few medium sand, 60-70% fines (field estimate), low plasticity @2.5': SANDY CLAY, very stiff, reddish brown, moist, fine sand, some medium sand, 60-70% fines (field estimate), low to medium plasticity, trace asphalt chunks @5': SANDY CLAY, very stiff, reddish brown, moist, fine sand, some medium sand, 55-65% fines (field estimate), low to medium plasticity	SA, MD, EI
	35			B-1				CL		
	5			R-1	12 16 24	122	12	CL		
				R-2	9 16 25	121	13	CL		
	30			R-3	12 11 12	119	10	CL-SC	Old Alluvial Fan Deposit (Qopf) @7.5': SANDY CLAY to CLAYEY SAND, very stiff to medium dense, reddish brown, moist, fine sand, 45-60% fines (field estimate), low plasticity	CO
	10			R-4	7 9 20	103	17	SM	@10': SILTY SAND, medium dense, yellowish brown, slightly moist, fine sand, 25-35% fines (field estimate), low plasticity, grading slightly coarser toward bottom, 10-20% fines (field estimate)	
	25			R-5	10 16 23			ML	@12.5': SANDY SILT, very stiff, gray brown, slightly moist, very fine sand, 70-80% fines (field estimate), low plasticity	
	15			R-6	9 16 22			ML	@15': SANDY SILT, very stiff, gray brown, slightly moist, very fine sand, 50-60% fines (field estimate), low plasticity	
	20			S-7	5 7 9			ML	@20': SANDY SILT with CLAY, very stiff, grayish brown, moist, fine sand, 55-65% fines (field estimate), low plasticity	
	25			R-8	19 24 22			ML-SM	@25': SANDY SILT to SILTY SAND, hard to dense, gray brown, moist to very moist, very fine sand, 45-60% fines (field estimate), low plasticity	
	10									
	30									

SAMPLE TYPES:

B BULK SAMPLE
 C CORE SAMPLE
 G GRAB SAMPLE
 R RING SAMPLE
 S SPLIT SPOON SAMPLE
 T TUBE SAMPLE

TYPE OF TESTS:

-200 % FINES PASSING
 AL ATTERBERG LIMITS
 CN CONSOLIDATION
 CO COLLAPSE
 CR CORROSION
 CU UNDRAINED TRIAXIAL

DS DIRECT SHEAR
 EI EXPANSION INDEX
 H HYDROMETER
 MD MAXIMUM DENSITY
 PP POCKET PENETROMETER
 RV R VALUE

SA SIEVE ANALYSIS
 SE SAND EQUIVALENT
 SG SPECIFIC GRAVITY
 UC UNCONFINED COMPRESSIVE STRENGTH



GEOTECHNICAL BORING LOG LB-1

Project No. 038.0000024475
 Project PBK Costa Mesa FS No. 2 Replacement GE
 Drilling Co. 2R Drilling, Inc.
 Drilling Method Hollow Stem Auger - 140lb - Autohammer - 30" Drop
 Location See Figure 2 - Exploration Location Map

Date Drilled 6-17-24
 Logged By BTM
 Hole Diameter 8"
 Ground Elevation 39'
 Sampled By BTM

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION <i>This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.</i>	Type of Tests
30		N S		S-9	4 5 6		24	CL	@30': LEAN CLAY with SAND, stiff, gray and orange, very moist to saturated, 79% fines (lab), low to medium plasticity, oxidation staining	-200, AL
5				R-10	9 15 22			ML	@35': SANDY SILT, very stiff, light gray, very moist, very fine sand, 70-80% fines (field estimate), low plasticity	
40				S-11	9 27 31			SP-SM	@40': POORLY-GRADED SAND with SILT, very dense, yellowish brown, very moist to saturated, mostly fine sand, few medium to coarse sand, few fines, nonplastic	
45				R-12	50/6"			SP-SM	@45': POORLY-GRADED SAND with SILT, very dense, yellowish brown, very moist to saturated, mostly fine sand, some medium to coarse sand, few fines, nonplastic	
50				S-13	5 7 10			SP-SM	@50': POORLY-GRADED SAND with SILT, very dense, yellowish brown, very moist to saturated, mostly fine sand, some medium to coarse sand, few fines, nonplastic	-200, AL
							27	CL	@51': LEAN CLAY, very stiff, dark gray, very moist, very fine sand, 90% fines (lab), low plasticity, slightly micaceous	
									Total Depth: 51.5 feet bgs Groundwater encountered at 31 feet bgs, rose to 25 feet after ~10 minutes Boring backfilled with soil cuttings and patched at surface with cold-mix asphalt.	

SAMPLE TYPES:

B BULK SAMPLE
 C CORE SAMPLE
 G GRAB SAMPLE
 R RING SAMPLE
 S SPLIT SPOON SAMPLE
 T TUBE SAMPLE

TYPE OF TESTS:

-200 % FINES PASSING
 AL ATTERBERG LIMITS
 CN CONSOLIDATION
 CO COLLAPSE
 CR CORROSION
 CU UNDRAINED TRIAXIAL

DS DIRECT SHEAR
 EI EXPANSION INDEX
 H HYDROMETER
 MD MAXIMUM DENSITY
 PP POCKET PENETROMETER
 RV R VALUE

SA SIEVE ANALYSIS
 SE SAND EQUIVALENT
 SG SPECIFIC GRAVITY
 UC UNCONFINED COMPRESSIVE STRENGTH



GEOTECHNICAL BORING LOG LB-2

Project No. 038.0000024475
 Project PBK Costa Mesa FS No. 2 Replacement GE
 Drilling Co. 2R Drilling, Inc.
 Drilling Method Hollow Stem Auger - 140lb - Autohammer - 30" Drop
 Location See Figure 2 - Exploration Location Map

Date Drilled 6-17-24
 Logged By BTM
 Hole Diameter 8"
 Ground Elevation 38'
 Sampled By BTM

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION <i>This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.</i>	Type of Tests
0	0	N S							Artificial Fill, undocumented (Afu) @Surface: 5.5-inches asphalt concrete over 4-inches base	RV, CR
35	35			B-1				CL	@9.5": SANDY CLAY, reddish brown, moist, fine sand, 55-65% fines (field estimate), low plasticity	
				R-1	8 15 22	120	14	CL	@2.5': SANDY CLAY, very stiff, brown, mottled with lighter brown, slightly moist, fine sand, 65-75% fines (field estimate), low to medium plasticity	
5	5			R-2	10 20 32			CL	Old Alluvial Fan Deposit (Qopf) @5': SANDY CLAY, hard, reddish brown, slightly moist, fine sand, few medium sand, 65-75% fines (field estimate), low plasticity, slightly micaceous	
30	30			R-3	7 10 16	103	21	ML	@7.5': SANDY SILT, very stiff, white to light gray, slightly moist, very fine sand, few medium to coarse sand, 60-75% fines (field estimate), low plasticity; grading to SILTY SAND, light brown, slightly moist, fine sand, 20-30% fines (field estimate)	
10	10			R-4	9 11 11			SM	@10': SILTY SAND, medium dense, light brown, slightly moist, fine sand, 20-30% fines (field estimate), low plasticity, slightly micaceous; grading to SANDY SILT with CLAY, stiff, gray, slightly moist, fine sand, 60-70% fines (field estimate), low plasticity, slight oxidation	
25	25			R-5	11 15 20	105	24	ML	@12.5': SANDY SILT with CLAY, very stiff, gray, slightly moist, fine sand, 60-70% fines (field estimate), low plasticity, oxidation staining	
15	15			S-6	5 10 12			ML	@15': SANDY SILT with CLAY, very stiff, gray, slightly moist, fine sand, 50-60% fines (field estimate), low plasticity, oxidation staining	
20	20			R-7	10 20 30			ML-SM	@20': SILTY SAND to SANDY SILT, dense to hard, grayish brown, slightly moist, fine sand, 40-60% fines (field estimate), low plasticity, slightly micaceous	
15	15									
25	25			S-8	4 8 12			ML-SM	@25': SILTY SAND to SANDY SILT, medium dense to very stiff, light brown, moist, fine sand, 40-60% fines (field estimate), low plasticity, slightly micaceous	
10	10									
30	30									

SAMPLE TYPES:

B BULK SAMPLE
 C CORE SAMPLE
 G GRAB SAMPLE
 R RING SAMPLE
 S SPLIT SPOON SAMPLE
 T TUBE SAMPLE

TYPE OF TESTS:

-200 % FINES PASSING
 AL ATTERBERG LIMITS
 CN CONSOLIDATION
 CO COLLAPSE
 CR CORROSION
 CU UNDRAINED TRIAXIAL

DS DIRECT SHEAR
 EI EXPANSION INDEX
 H HYDROMETER
 MD MAXIMUM DENSITY
 PP POCKET PENETROMETER
 RV R VALUE

SA SIEVE ANALYSIS
 SE SAND EQUIVALENT
 SG SPECIFIC GRAVITY
 UC UNCONFINED COMPRESSIVE STRENGTH



GEOTECHNICAL BORING LOG LB-2

Project No. 038.0000024475
 Project PBK Costa Mesa FS No. 2 Replacement GE
 Drilling Co. 2R Drilling, Inc.
 Drilling Method Hollow Stem Auger - 140lb - Autohammer - 30" Drop
 Location See Figure 2 - Exploration Location Map

Date Drilled 6-17-24
 Logged By BTM
 Hole Diameter 8"
 Ground Elevation 38'
 Sampled By BTM

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							<i>This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.</i>	
30				R-9	10 14 15			CL	@30': SANDY CLAY, very stiff, brown, very moist to saturated, fine sand, 60-75% fines (field estimate), low to medium plasticity	
5									Total Depth: 31.5 feet bgs Groundwater encountered at 27 feet bgs, rose to 24 feet after ~10 minutes Boring backfilled with soil cuttings and patched at surface with cold-mix asphalt.	
35										
0										
40										
-5										
45										
-10										
50										
-15										
55										
-20										
60										

SAMPLE TYPES:

B BULK SAMPLE
 C CORE SAMPLE
 G GRAB SAMPLE
 R RING SAMPLE
 S SPLIT SPOON SAMPLE
 T TUBE SAMPLE

TYPE OF TESTS:

-200 % FINES PASSING
 AL ATTERBERG LIMITS
 CN CONSOLIDATION
 CO COLLAPSE
 CR CORROSION
 CU UNDRAINED TRIAXIAL

DS DIRECT SHEAR
 EI EXPANSION INDEX
 H HYDROMETER
 MD MAXIMUM DENSITY
 PP POCKET PENETROMETER
 RV R VALUE

SA SIEVE ANALYSIS
 SE SAND EQUIVALENT
 SG SPECIFIC GRAVITY
 UC UNCONFINED COMPRESSIVE STRENGTH



GEOTECHNICAL BORING LOG LB-3 / IT-1

Project No. 038.0000024475
 Project PBK Costa Mesa FS No. 2 Replacement GE
 Drilling Co. 2R Drilling, Inc.
 Drilling Method Hollow Stem Auger - 140lb - Autohammer - 30" Drop
 Location See Figure 2 - Exploration Location Map

Date Drilled 6-17-24
 Logged By BTM
 Hole Diameter 8"
 Ground Elevation 38'
 Sampled By BTM

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							<i>This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.</i>	
	0								Artificial Fill, undocumented (Afu) @Surface: 5 inches asphalt over 9 inches of old asphalt and base mixture	
	35			B-1				CL	@1.17': SANDY CLAY, reddish brown, moist, fine sand, 65-75% fines (field estimate), medium plasticity	
	5			S-1	7 10 11			SC	Old Alluvial Fan Deposit (Qopf) @5': CLAYEY SAND, very stiff, reddish brown, moist, fine sand, few medium sand, 35-45% fines (field estimate), low plasticity, micaceous	
	30									
	10			S-2	5 5 6			SM CL-ML	@10': SILTY SAND, medium dense, light brown, slightly moist, very fine to fine sand, 20-30% fines (field estimate), low plasticity, micaceous @11': Grades quickly to SANDY SILTY CLAY, stiff, light brown to grayish brown, slightly moist, very fine to fine sand, 70% fines (lab), low plasticity, micaceous	-200
	25			S-3	5 8 10			CL	@13.5': SANDY LEAN CLAY, very stiff, light brown, moist, very fine sand, 61% fines (lab), low plasticity, little oxidation staining	-200
	15									
	20								Total Depth: 15 feet bgs No groundwater encountered during drilling Temporary percolation well installed; screened from 10 to 15 feet bgs Upon completion of infiltration testing, boring backfilled with soil cuttings to surface and patched at surface with cold-mix asphalt.	
	20									
	15									
	25									
	10									
	30									

SAMPLE TYPES:

B BULK SAMPLE
 C CORE SAMPLE
 G GRAB SAMPLE
 R RING SAMPLE
 S SPLIT SPOON SAMPLE
 T TUBE SAMPLE

TYPE OF TESTS:

-200 % FINES PASSING
 AL ATTERBERG LIMITS
 CN CONSOLIDATION
 CO COLLAPSE
 CR CORROSION
 CU UNDRAINED TRIAXIAL

DS DIRECT SHEAR
 EI EXPANSION INDEX
 H HYDROMETER
 MD MAXIMUM DENSITY
 PP POCKET PENETROMETER
 RV R VALUE

SA SIEVE ANALYSIS
 SE SAND EQUIVALENT
 SG SPECIFIC GRAVITY
 UC UNCONFINED COMPRESSIVE STRENGTH



GEOTECHNICAL BORING LOG LB-4 / IT-2

Project No. 038.0000024475
 Project PBK Costa Mesa FS No. 2 Replacement GE
 Drilling Co. 2R Drilling, Inc.
 Drilling Method Hollow Stem Auger - 140lb - Autohammer - 30" Drop
 Location See Figure 2 - Exploration Location Map

Date Drilled 6-17-24
 Logged By BTM
 Hole Diameter 8"
 Ground Elevation 37'
 Sampled By BTM

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0	N S							<i>This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.</i>	
	35							CL	Artificial Fill, undocumented (Afu) @Surface: 5-inches asphalt concrete over 5-inches base @10": SANDY CLAY, reddish brown, moist, fine sand, few medium sand, 60-70% fines (field estimate), medium plasticity	
	5			S-1	6 7 8			SC-SM	Old Alluvial Fan Deposit (Qopf) @5": SILTY CLAYEY SAND, medium dense, reddish brown, moist, fine to medium sand, 48% fines (lab), low plasticity, micaceous	-200
	30			S-2	8 11 14			SP-SM	@8.5': POORLY-GRADED SAND with SILT, medium dense, brown to reddish brown, moist, fine to medium sand, trace coarse sand, 6% fines (lab), low plasticity, slightly micaceous	-200
	10									
	25									
	15									
	20									
	20									
	15									
	25									
	10									
	30									
SAMPLE TYPES: B BULK SAMPLE C CORE SAMPLE G GRAB SAMPLE R RING SAMPLE S SPLIT SPOON SAMPLE T TUBE SAMPLE TYPE OF TESTS: -200 % FINES PASSING AL ATTERBERG LIMITS CN CONSOLIDATION CO COLLAPSE CR CORROSION CU UNDRAINED TRIAXIAL DS DIRECT SHEAR EI EXPANSION INDEX H HYDROMETER MD MAXIMUM DENSITY PP POCKET PENETROMETER RV R VALUE SA SIEVE ANALYSIS SE SAND EQUIVALENT SG SPECIFIC GRAVITY UC UNCONFINED COMPRESSIVE STRENGTH										



Raw Rate for design, prior to application of adjustment factors:

Leighton

APPENDIX B

GEOTECHNICAL LABORATORY TESTING

Our geotechnical laboratory testing program was directed toward a quantitative and qualitative evaluation of physical and mechanical properties of soils underlying proposed improvements, and to aid in verifying soil classification.

In-Situ Moisture and Density: As-sampled soil moisture content was measured (ASTM D 2216) on selected samples recovered from our borings. In addition, in place dry density was measured (ASTM D 2937) on selected relatively undisturbed soil samples. Results of these tests are shown on our logs at the appropriate sample depths in Appendix A.

Percent Passing No. 200 Sieve: Percent fines (silt and clay) passing the No. 200 U.S. Standard Sieve was determined for soil samples in accordance with ASTM D 1140 Standard Test Method. Samples were dried and passed through a No. 4 sieve, then a No. 200 sieve. Result of this grain size analysis, as percent by dry weight passing the No. 200 U.S. Standard Sieve, is tabulated in this appendix and entered on our boring logs.

Modified Proctor Compaction Curve: A laboratory modified Proctor compaction curve (ASTM D1557) was established for bulk soil-sample to evaluate the modified Proctor laboratory maximum dry density and optimum moisture content. Results of this test are presented on the following *Modified Proctor Compaction Test* sheet in this appendix.

Corrosivity Tests: To evaluate corrosion potential of subsurface soils at the site, we tested a bulk soil sample collected during our subsurface exploration for pH, electrical resistivity (CTM 532/643), soluble sulfate content (CTM 417 Part II) and soluble chloride content (CTM 422) testing. Results of these tests are enclosed at the end of this appendix.

Expansion Index (EI): An Expansion Index (EI) test was performed on a representative shallow bulk soil sample from this site, in general accordance with the ASTM D4829 Standard Test Method.

Atterberg Limits (AL): Liquid Limit (LL), Plastic Limit (PL) and Plasticity Index (PI) were determined for soil samples in accordance with ASTM D4318 Standard Test Method. Soil

samples were air-dried and passed through a No. 40 sieve, then re-moisturized. Liquid Limit and Plastic Limit tests were performed on fraction of soil samples passing the No. 40 sieve. Results of these tests are presented on the “*Atterberg Limits*” sheet in this appendix.

Swell or Collapse of Soils (CO): Swell or collapse of soil tests were performed on relatively-undisturbed ring-lined drive-sampler soil samples, to measure the magnitude of one-dimensional wetting-induced swell or collapse on unsaturated soils. Results are presented in this appendix on the *One-Dimensional Swell or Collapse of Soils* (ASTM D 4546) sheets.

Resistance Value (R-Value): R-Value for a shallow bulk soil sample was established by California Test Method 301 to assist in preliminary pavement design recommendations. R-Value results are presented in this appendix on the *R-Value Test Results* sheets.



MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name: PBK Costa Mesa FS No. 2 Replacement Tested By: M. Saba Date: 07/02/24
Project No.: 038.0000024475 Checked By: A. Santos Date: 07/05/24
Boring No.: LB-1 Depth (ft.): 2-5
Sample No.: B-1
Soil Identification: Yellowish brown sandy lean clay s(CL)

Preparation Method:



Moist
Dry



Mechanical Ram
Manual Ram

Mold Volume (ft³)

0.03320

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	<u>3731</u>	<u>3905</u>	<u>3909</u>			
Weight of Mold (g)	<u>1780</u>	<u>1780</u>	<u>1780</u>			
Net Weight of Soil (g)	<u>1951</u>	<u>2125</u>	<u>2129</u>			
Wet Weight of Soil + Cont. (g)	<u>864.3</u>	<u>959.3</u>	<u>928.2</u>			
Dry Weight of Soil + Cont. (g)	<u>832.6</u>	<u>900.8</u>	<u>852.3</u>			
Weight of Container (g)	<u>75.6</u>	<u>76.5</u>	<u>79.2</u>			
Moisture Content (%)	<u>4.19</u>	<u>7.10</u>	<u>9.82</u>			
Wet Density (pcf)	<u>129.6</u>	<u>141.1</u>	<u>141.4</u>			
Dry Density (pcf)	<u>124.3</u>	<u>131.8</u>	<u>128.7</u>			

Maximum Dry Density (pcf)

131.9

Optimum Moisture Content (%)

7.6

PROCEDURE USED

☒ Procedure A

Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if + #4 is 20% or less

☐ Procedure B

Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if + #4 is >20% and + 3/8 in. is 20% or less

☐ Procedure C

Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if + 3/8 in. is >20% and + 3/4 in. is <30%

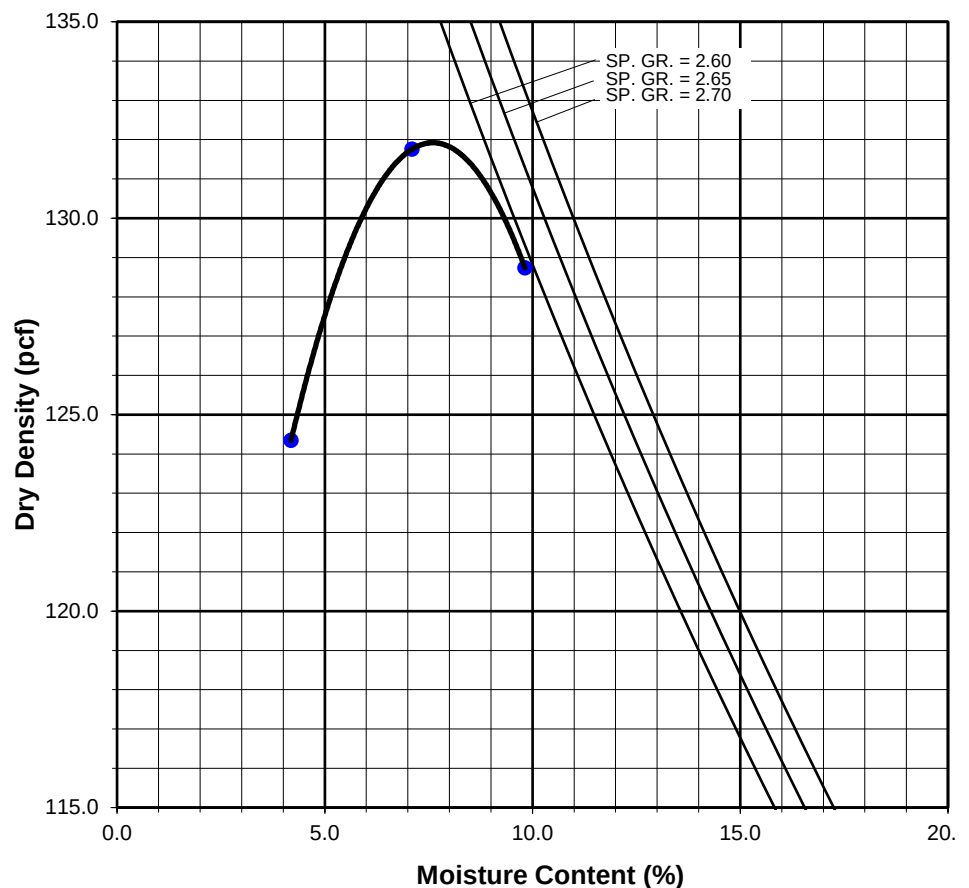
Particle-Size Distribution:

1:46:53

GR:SA:FI

Atterberg Limits:

LL, PL, PI





PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS

ASTM D6913

Project Name: PBK Costa Mesa FS No. 2 Replacement

Tested By: G. Bathala Date: 06/26/24

Project No.: 038.0000024475

Checked By: J. Ward Date: 07/09/24

Boring No.: LB-1

Depth (feet): 2-5

Sample No.: B-1

Soil Identification: Yellowish brown sandy lean clay s(CL)

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	CP-15	WR	Wt. of Air-Dry Soil + Cont.(g)	0.0	0.0
Wt. Air-Dried Soil + Cont.(g)	2406.8	721.9	Wt. of Dry Soil + Cont. (g)	0.0	0.0
Wt. of Container (g)	223.1	236.6	Wt. of Container No. (g)	1.0	1.0
Dry Wt. of Soil (g)	2183.7	485.3	Moisture Content (%)	0.0	0.0

Passing #4 Material After Wet Sieve	Container No.	WR
	Wt. of Dry Soil + Container (g)	472.0
	Wt. of Container (g)	236.6
	Dry Wt. of Soil Retained on # 200 Sieve (g)	235.4

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained (g)		Percent Passing (%)
	(mm.)	Whole Sample	Sample Passing #4	
3"	75.0			
1 1/2"	37.5			
1"	25.0			
3/4"	19.0			
1/2"	12.5	0.0		100.0
3/8"	9.5	6.6		99.7
#4	4.75	15.4		99.3
#8	2.36		3.0	98.7
#16	1.18		11.3	97.0
#30	0.600		34.4	92.3
#50	0.300		80.0	82.9
#100	0.150		147.6	69.1
#200	0.075		227.0	52.9
PAN				

GRAVEL: **1 %**

SAND: **46 %**

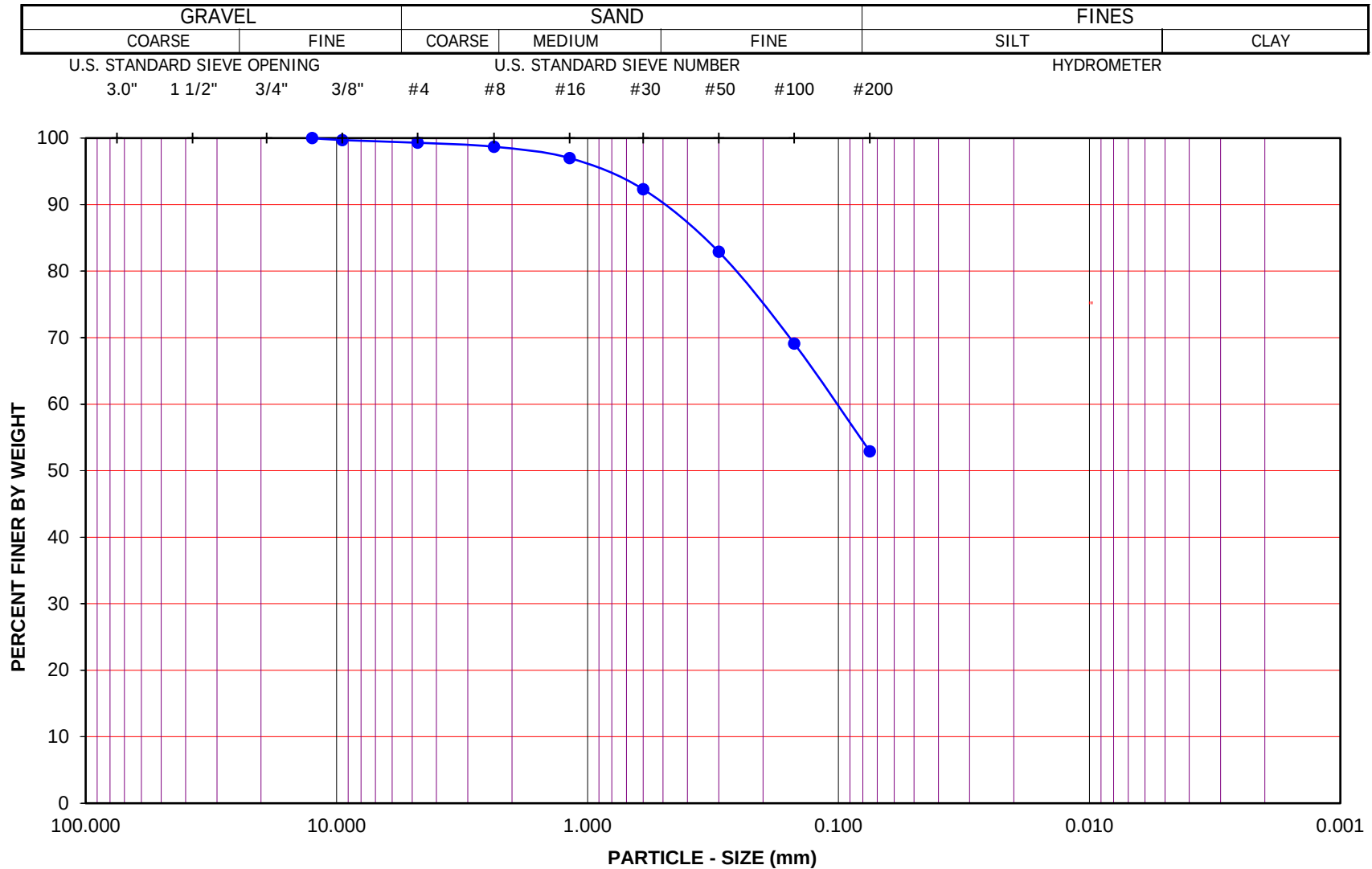
FINES: **53 %**

GROUP SYMBOL: **s(CL)**

Cu = D60/D10 = _____

Cc = (D30)²/(D60*D10) = _____

Remarks: _____



Project Name: PBK Costa Mesa FS No. 2 Replacement

Project No.: 038.0000024475

Boring No.: LB-1 Sample No.: B-1

Depth (feet): 2-5 Soil Type : s(CL)

Soil Identification: Yellowish brown sandy lean clay s(CL)

GR:SA:FI : (%) 1 : 46 : 53



**PARTICLE - SIZE
DISTRIBUTION
ASTM D 6913**

Jul-24

Boring No.	LB-1	LB-1	LB-3/IT-1	LB-3/IT-1	LB-4/IT-2	LB-4/IT-2		
Sample No.	S-9	S-13B	S-2B	S-3	S-1	S-2		
Depth (ft.)	30.0	51.0	11.0	13.5	5.0	8.5		
Sample Type	SPT	SPT	SPT	SPT	SPT	SPT		
Soil Identification	Light olive brown lean clay with sand (CL)s	Olive gray lean clay (CL)	Olive gray sandy silty clay s(CL-ML), caliche noted	Olive gray sandy lean clay s(CL)	Yellowish brown silty, clayey sand (SC-SM)	Yellowish brown poorly-graded sand with silt (SP-SM)		
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00	0.00		
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00	0.00		
Weight of Container (g)	1.00	1.00	1.00	1.00	1.00	1.00		
Moisture Content (%)	0.00	0.00	0.00	0.00	0.00	0.00		
Sample Dry Weight Determination								
Weight of Sample + Container (g)	418.47	424.61	351.20	427.67	423.20	657.39		
Weight of Container (g)	77.06	82.49	75.46	74.50	87.76	76.67		
Weight of Dry Sample (g)	341.41	342.12	275.74	353.17	335.44	580.72		
Container No.:								
After Wash								
Method (A or B)	B	B	B	B	B	A		
Dry Weight of Sample + Cont. (g)	148.34	116.45	157.74	213.80	262.40	621.02		
Weight of Container (g)	77.06	82.49	75.46	74.50	87.76	76.67		
Dry Weight of Sample (g)	71.28	33.96	82.28	139.30	174.64	544.35		
% Passing No. 200 Sieve	79.1	90.1	70.2	60.6	47.9	6.3		
% Retained No. 200 Sieve	20.9	9.9	29.8	39.4	52.1	93.7		
 PERCENT PASSING No. 200 SIEVE ASTM D 1140 Project Name: <u>PBK Costa Mesa FS No. 2 Replacement</u> Project No.: <u>038.0000024475</u> Tested By: <u>G. Bathala</u> Date: <u>06/28/24</u>								



EXPANSION INDEX of SOILS
ASTM D 4829

Project Name: PBK Costa Mesa FS No. 2 Replacement Tested By: G. Berdy Date: 06/27/24
Project No.: 038.0000024475 Checked By: J. Ward Date: 07/09/24
Boring No.: LB-1 Depth (ft.): 2-5
Sample No.: B-1
Soil Identification: Yellowish brown sandy lean clay s(CL)

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0080
Wt. Comp. Soil + Mold (g)	621.20	456.52
Wt. of Mold (g)	190.00	0.00
Specific Gravity (Assumed)	2.70	2.70
Container No.	0	0
Wet Wt. of Soil + Cont. (g)	730.00	646.52
Dry Wt. of Soil + Cont. (g)	679.10	591.13
Wt. of Container (g)	0.00	190.00
Moisture Content (%)	7.50	13.81
Wet Density (pcf)	130.1	136.6
Dry Density (pcf)	121.0	120.0
Void Ratio	0.393	0.404
Total Porosity	0.282	0.288
Pore Volume (cc)	58.4	60.1
Degree of Saturation (%) [S meas]	51.5	92.2

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
06/27/24	12:24	1.0	0	0.5315
06/27/24	12:34	1.0	10	0.5310
Add Distilled Water to the Specimen				
06/27/24	13:32	1.0	58	0.5365
06/28/24	6:08	1.0	1054	0.5395
06/28/24	9:29	1.0	1255	0.5395

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	8
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ATTERBERG LIMITS ASTM D 4318

Project Name: PBK Costa Mesa FS No. 2 Replacement Tested By: J. Domingo Date: 07/02/24
Project No. : 038.0000024475 Input By: G. Bathala Date: 07/05/24
Boring No.: LB-1 Checked By: J. Ward
Sample No.: S-9 Depth (ft.) 30.0
Soil Identification: Light olive brown lean clay with sand (CL)s

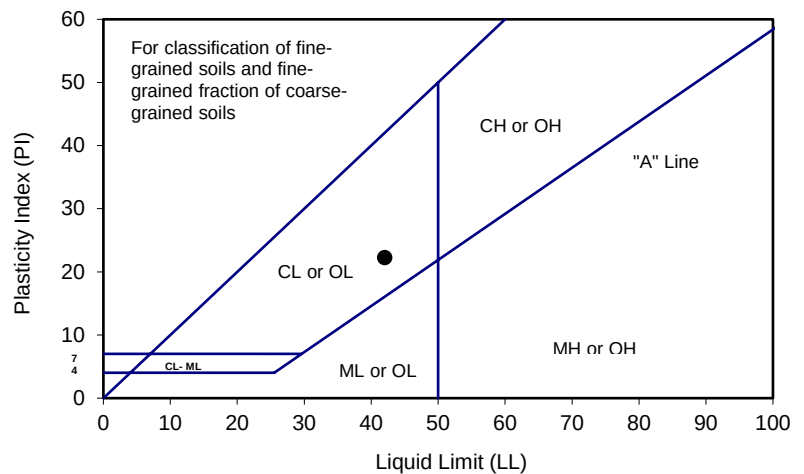
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			32	24	15	
Wet Wt. of Soil + Cont. (g)	9.83	9.91	20.39	19.65	20.88	
Dry Wt. of Soil + Cont. (g)	8.39	8.45	14.82	14.09	14.71	
Wt. of Container (g)	1.10	1.06	1.10	1.07	1.13	
Moisture Content (%) [Wn]	19.75	19.76	40.60	42.70	45.43	

Liquid Limit	42
Plastic Limit	20
Plasticity Index	22
Classification	CL

PI at "A" - Line = $0.73(LL-20)$ 16.06

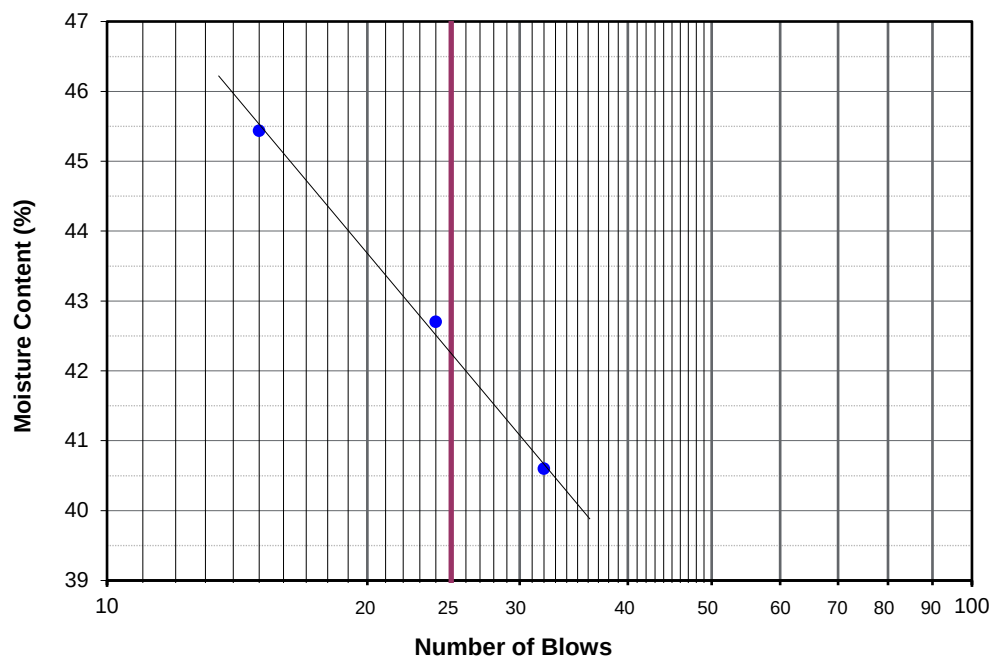
One - Point Liquid Limit Calculation

$$LL = Wn(N/25)^{0.12}$$



PROCEDURES USED

- ☐ Wet Preparation
Multipoint - Wet
- ☒ Dry Preparation
Multipoint - Dry
- ☒ Procedure A
Multipoint Test
- ☐ Procedure B
One-point Test





ATTERBERG LIMITS ASTM D 4318

Project Name: PBK Costa Mesa FS No. 2 Replacement Tested By: J. Domingo Date: 07/06/24
Project No.: 038.0000024475 Input By: JD/JHW Date: 07/08/24
Boring No.: LB-1 Checked By: J. Ward
Sample No.: S-13B Depth (ft.): 51.0
Soil Identification: Olive gray lean clay (CL)

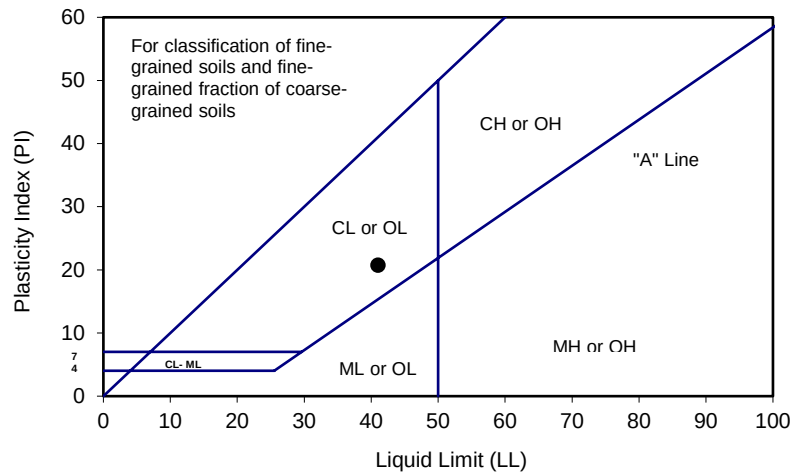
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			31	25	17	
Wet Wt. of Soil + Cont. (g)	9.40	9.38	21.45	21.84	21.50	
Dry Wt. of Soil + Cont. (g)	8.00	7.98	15.64	15.79	15.31	
Wt. of Container (g)	1.06	1.08	1.08	1.11	1.08	
Moisture Content (%) [Wn]	20.17	20.29	39.90	41.21	43.50	

Liquid Limit	41
Plastic Limit	20
Plasticity Index	21
Classification	CL

PI at "A" - Line = $0.73(LL-20)$ 15.33

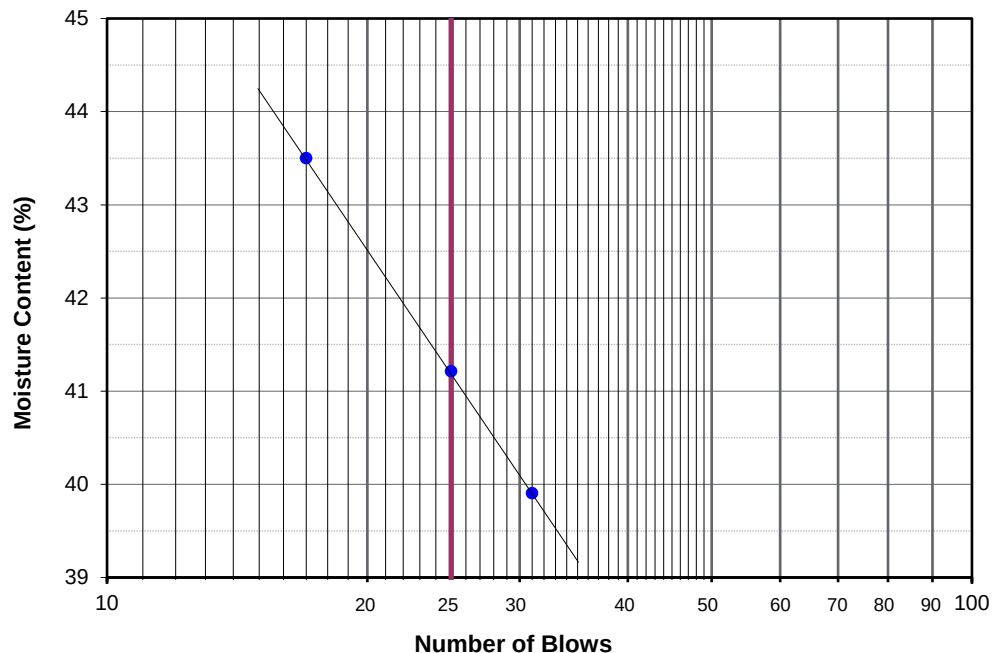
One - Point Liquid Limit Calculation

$$LL = Wn(N/25)^{0.12}$$



PROCEDURES USED

- ☐ Wet Preparation
Multipoint - Wet
- ☒ Dry Preparation
Multipoint - Dry
- ☒ Procedure A
Multipoint Test
- ☐ Procedure B
One-point Test





**ONE-DIMENSIONAL SWELL OR SETTLEMENT
POTENTIAL OF COHESIVE SOILS**
ASTM D 4546

Project Name: PBK Costa Mesa FS No. 2 Replacement Tested By: G. Bathala Date: 06/26/24
Project No.: 038.0000024475 Checked By: J. Ward Date: 07/09/24
Boring No.: LB-1 Sample Type: Ring
Sample No.: R-3 Depth (ft.): 7.5
Sample Description: Yellowish brown lean clay (CL)

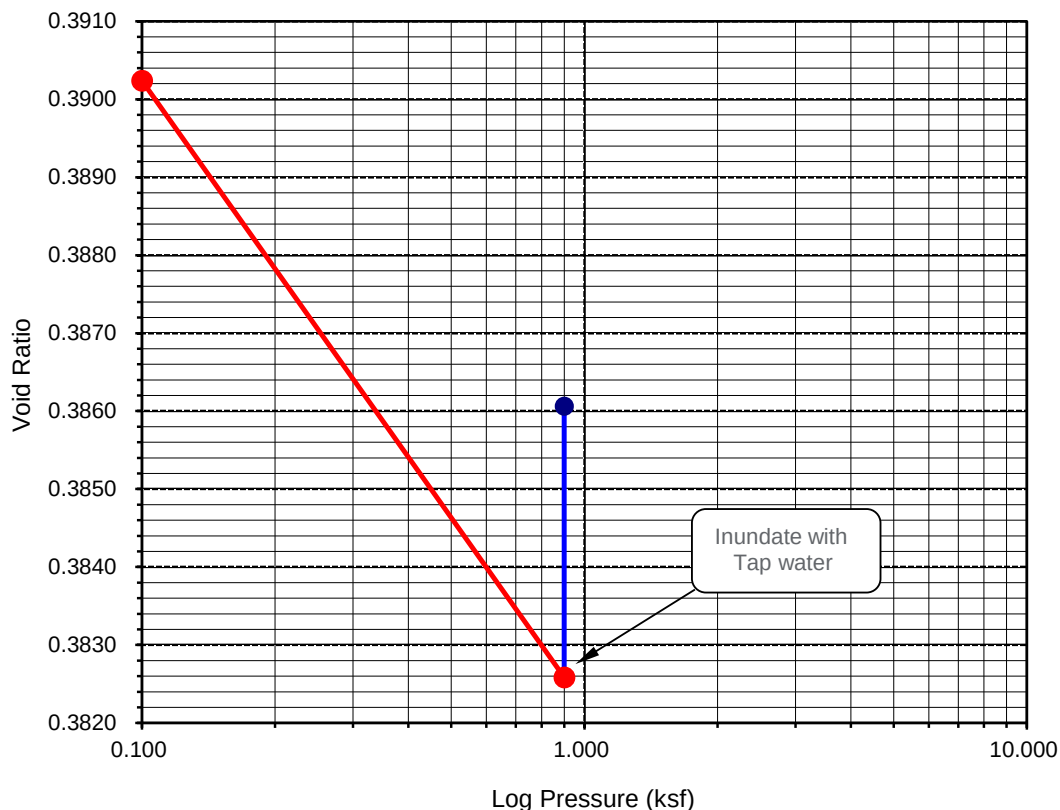
Initial Dry Density (pcf):	121.1
Initial Moisture (%):	10.30
Initial Length (in.):	1.0000
Initial Dial Reading:	0.0276
Diameter(in):	2.415

Final Dry Density (pcf):	121.9
Final Moisture (%) :	15.5
Initial Void ratio:	0.3914
Specific Gravity(assumed):	2.70
Initial Saturation (%)	71.0

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.100	0.0284	0.9992	0.00	-0.08	0.3902	-0.08
0.900	0.0352	0.9924	0.13	-0.76	0.3826	-0.63
H2O	0.0327	0.9949	0.13	-0.51	0.3861	-0.38

Percent Swell (+) / Settlement (-) After Inundation = **0.25**

Void Ratio - Log Pressure Curve





**TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS**

Project Name: PBK Costa Mesa FS No. 2 Replacement Tested By : G. Berdy Date: 06/26/24
Project No. : 038.0000024475 Checked By: J. Ward Date: 07/09/24

Boring No.	LB-2			
Sample No.	B-1			
Sample Depth (ft)	0-5			
Soil Identification:	Brown CL			
Wet Weight of Soil + Container (g)	0.00			
Dry Weight of Soil + Container (g)	0.00			
Weight of Container (g)	1.00			
Moisture Content (%)	0.00			
Weight of Soaked Soil (g)	100.74			

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	15			
Crucible No.	302/303			
Furnace Temperature (°C)	860			
Time In / Time Out	7:30/8:15			
Duration of Combustion (min)	45			
Wt. of Crucible + Residue (g)	122.9876			
Wt. of Crucible (g)	122.9852			
Wt. of Residue (g) (A)	0.0024			
PPM of Sulfate (A) x 41150	98.76			
PPM of Sulfate, Dry Weight Basis	99			

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)	15			
ml of AgNO ₃ Soln. Used in Titration (C)	0.8			
PPM of Chloride (C - 0.2) * 100 * 30 / B	120			
PPM of Chloride, Dry Wt. Basis	120			

pH TEST, DOT California Test 643

pH Value	9.10			
Temperature °C	21.7			



SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name: PBK Costa Mesa FS No. 2 Replacement

Tested By : G. Berdy Date: 06/27/24

Project No. : 038.0000024475

Checked By: J. Ward Date: 07/09/24

Boring No.: LB-2

Depth (ft.) : 0-5

Sample No. : B-1

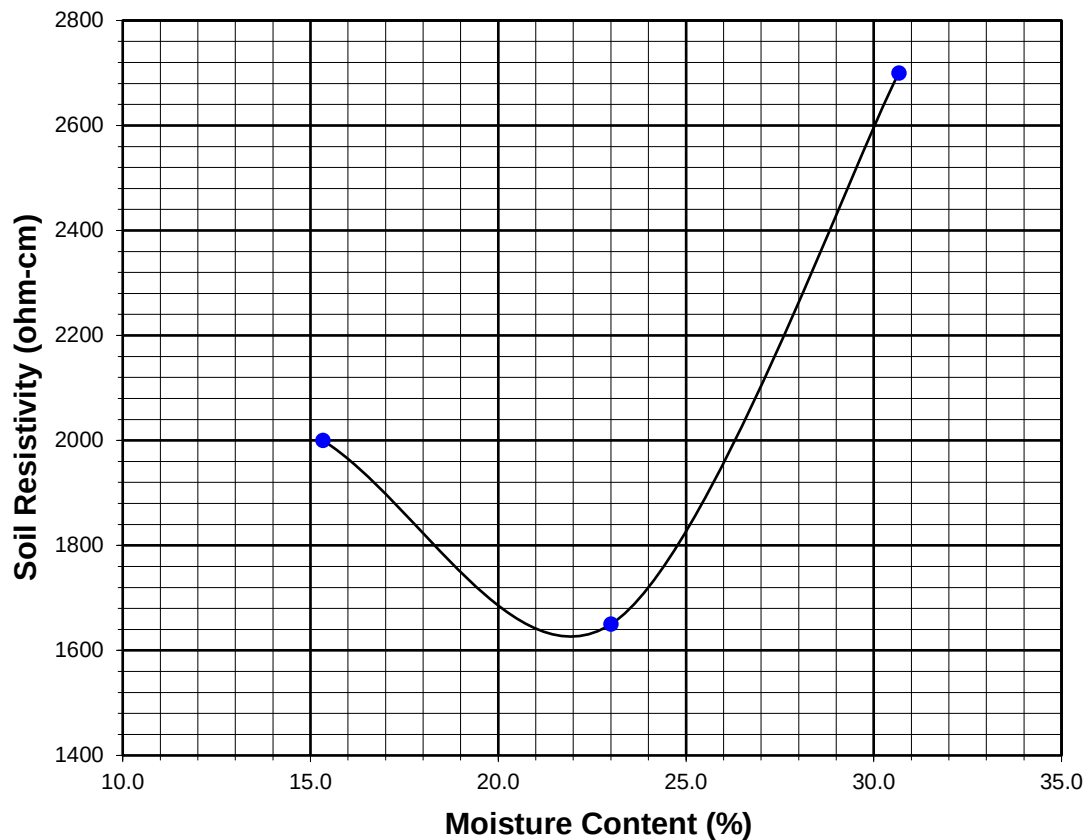
Soil Identification:* Brown CL

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	20	15.34	2000	2000
2	30	23.00	1650	1650
3	40	30.67	2700	2700
4				
5				

Moisture Content (%) (Mci)	0.00
Wet Wt. of Soil + Cont. (g)	0.00
Dry Wt. of Soil + Cont. (g)	0.00
Wt. of Container (g)	1.00
Container No.	
Initial Soil Wt. (g) (Wt)	130.42
Box Constant	1.000
$MC = (((1 + Mci/100) \times (Wa/Wt + 1)) - 1) \times 100$	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
1620	22.0	99	120	9.10	21.7





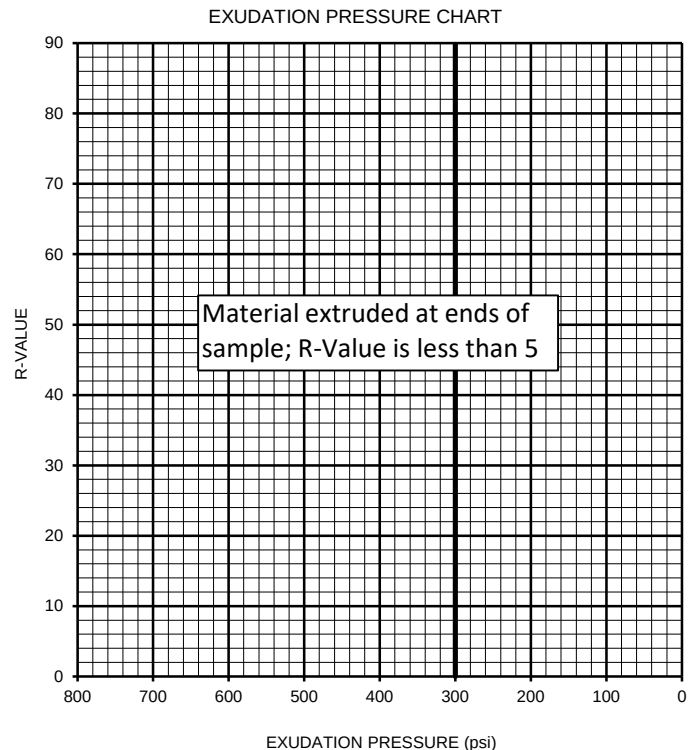
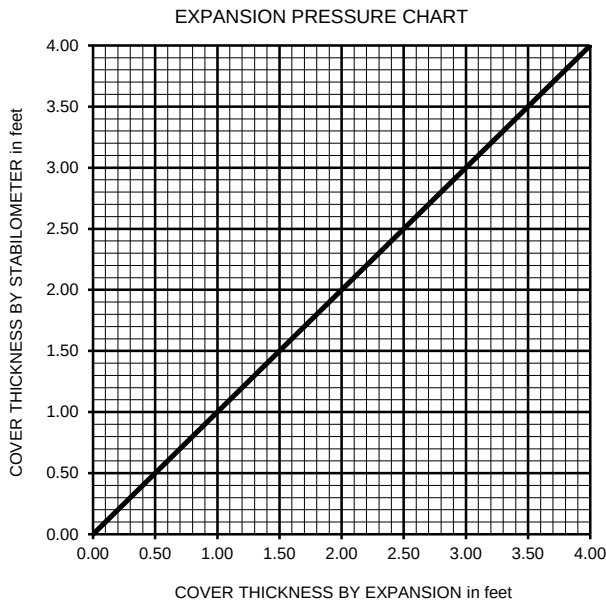
R-VALUE TEST RESULTS

DOT CA Test 301

PROJECT NAME:	PBK Costa Mesa FS No.2 Replacement	PROJECT NUMBER:	038.0000024475
BORING NUMBER:	LB-2	DEPTH (FT.):	0 - 5.0
SAMPLE NUMBER:	B-1	TECHNICIAN:	F. Mina
SAMPLE DESCRIPTION:	Brown lean clay (CL)	DATE COMPLETED:	7/2/2024

TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %			
HEIGHT OF SAMPLE, Inches			
DRY DENSITY, pcf			
COMPACTOR PRESSURE, psi			
EXUDATION PRESSURE, psi			
EXPANSION, Inches x 10exp-4			
STABILITY Ph 2,000 lbs (160 psi)			
TURNS DISPLACEMENT			
R-VALUE UNCORRECTED	N/A	N/A	N/A
R-VALUE CORRECTED	N/A	N/A	N/A

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	N/A	N/A	N/A
EXPANSION PRESSURE THICKNESS, ft.	N/A	N/A	N/A



R-VALUE BY EXPANSION:	N/A
R-VALUE BY EXUDATION:	N/A
EQUILIBRIUM R-VALUE:	< 5

APPENDIX C

SEISMIC

Determination of Site Class and Estimation of Shear Wave Velocity

Project: 24475 Costa Mesa FS No. 2

Depth (ft)	di, Layer Thick (ft)	Field Blow Counts, Ni Corrected for Cs and sampler type Blows per foot (bpf)		Average Ni (bpf)	Ni Hammer Corr:	di / Ni
		LB-1	LB-2		1.3	
5	7.5	25	31	28	36	0.21
10	5	17	13	15	20	0.26
15	5	23	22	23	29	0.17
20	5	16	30	23	30	0.17
25	5	28	20	24	31	0.16
30	5	11	17	14	18	0.27
35	5	22		22	29	0.17
40	5	58		58	75	0.07
45	5	60		60	78	0.06
50	7.5	17		17	22	0.34
60	10	17	*Assumed based on blowcount at 50'	17	22	0.45
70	10	17		17	22	0.45
80	10	17		17	22	0.45
90	10	17		17	22	0.45
100	5	17		17	22	0.23
Summation	100					3.92
Navg = Sum(di) / Sum(di / Ni) =						26

Extract of ASCE 7-16 Table 20.3-1 Site Classification (2019 CBC 1613A.2.2):

Site Class	Soil Profile Name	Avg. N upper 100'		Vs30 (ft/sec)		Vs30 (m/s)		Site Avg N	Interpolated vs30 (ft/s)
		from	to	from	to	from	to		
A	Hard Rock	-		5000	10000	1524	3048	26	781
B	Rock	-		2500	5000	762	1524		
C	VD soil & soft rock	50.001	100	1200	2500	366	762		
D	Stiff Soil	15	50	600	1200	183	366		
E	Soft Soil	0	14.999	0	600	0	183		
F		-	-			0	0		

SITE CLASS, Table 20.3-1: **D**

Estimation of Average Shear Wave Velocity in upper 100 ft (Vs30):

	ft/s	m/s
Approx. Vs30 (interpolation of Table 20.3-1) =	781	238
Approx. Vs30 sands (Imai and Tonouchi, 1982) =	968	295
Approx. Vs30 sands (Sykora and Stokoe, 1983) =	839	256
Approx. Vs30 (Maheswari, Boominathan, Dodagoudar, 2009) =	797	243



Latitude, Longitude: 33.6806, -117.8899



Date	7/11/2024, 2:23:11 PM
Design Code Reference Document	ASCE7-16
Risk Category	IV
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.301	MCE_R ground motion. (for 0.2 second period)
S_1	0.466	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.301	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	0.867	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.558	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.614	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.301	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.412	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.159	Factored deterministic acceleration value. (0.2 second)
S1RT	0.466	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.504	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.746	Factored deterministic acceleration value. (1.0 second)
PGAd	0.888	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.558	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.922	Mapped value of the risk coefficient at short periods
C_{R1}	0.925	Mapped value of the risk coefficient at a period of 1 s
C_v	1.36	Vertical coefficient

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Unified Hazard Tool



Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

33.6806

Time Horizon

Return period in years

2475

Longitude

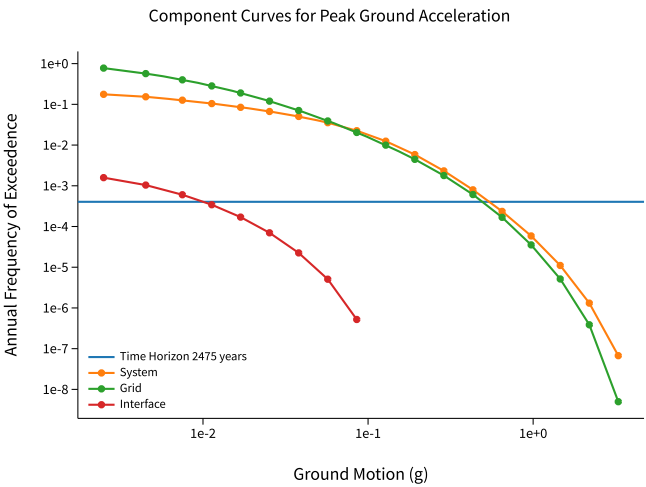
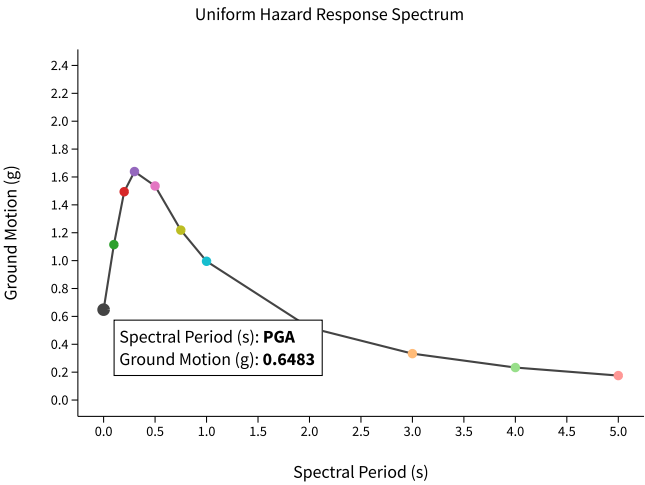
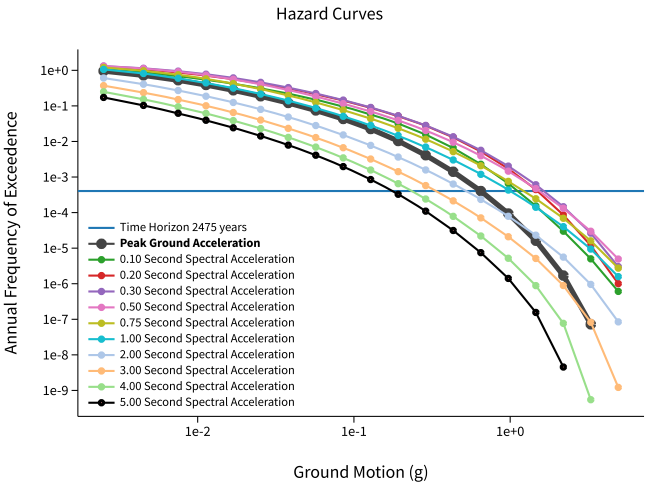
Decimal degrees, negative values for western longitudes

-117.8899

Site Class

259 m/s (Site class D)

^ Hazard Curve

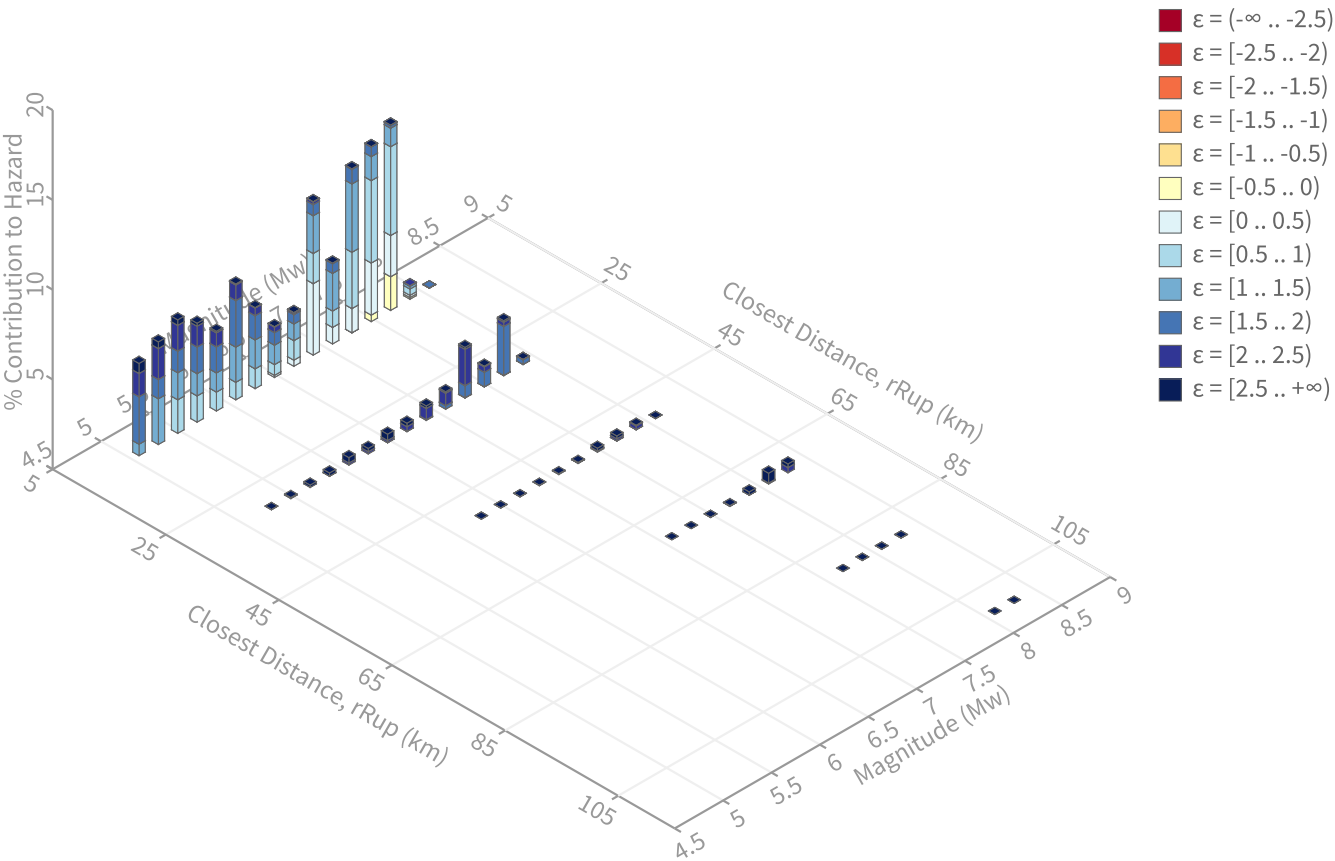


[View Raw Data](#)

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr⁻¹
PGA ground motion: 0.64830776 g

Recovered targets

Return period: 2964.6396 yrs
Exceedance rate: 0.00033730913 yr⁻¹

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.07 %

Mean (over all sources)

m: 6.67
r: 11.46 km
ε₀: 1.28 σ

Mode (largest m-r bin)

m: 7.69
r: 6.58 km
ε₀: 0.54 σ
Contribution: 10.32 %

Mode (largest m-r-ε₀ bin)

m: 7.68
r: 7.37 km
ε₀: 0.67 σ
Contribution: 4.94 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

- ε0:** [-∞ .. -2.5)
- ε1:** [-2.5 .. -2.0)
- ε2:** [-2.0 .. -1.5)
- ε3:** [-1.5 .. -1.0)
- ε4:** [-1.0 .. -0.5)
- ε5:** [-0.5 .. 0.0)
- ε6:** [0.0 .. 0.5)
- ε7:** [0.5 .. 1.0)
- ε8:** [1.0 .. 1.5)
- ε9:** [1.5 .. 2.0)
- ε10:** [2.0 .. 2.5)
- ε11:** [2.5 .. +∞]

Deaggregation Contributors

Source Set	Source	Type	r	m	ϵ_0	lon	lat	az	%
UC33brAvg_FM32		System							30.77
	San Joaquin Hills [0]		3.22	7.14	0.44	117.895°W	33.672°N	204.03	10.90
	Newport-Inglewood alt 2 [0]		7.87	7.49	0.84	117.956°W	33.638°N	232.07	5.82
	Compton [0]		15.29	7.35	1.13	118.043°W	33.702°N	279.77	3.47
	Palos Verdes [6]		25.96	7.46	2.00	118.134°W	33.567°N	240.77	1.78
	Newport-Inglewood (Offshore) [0]		10.27	6.59	1.56	117.915°W	33.591°N	192.91	1.20
	Whittier alt 2 [2]		26.88	7.65	1.89	117.746°W	33.891°N	29.58	1.07
UC33brAvg_FM31		System							27.19
	San Joaquin Hills [0]		3.22	7.52	0.34	117.895°W	33.672°N	204.03	7.58
	Newport-Inglewood alt 1 [0]		7.99	7.45	0.84	117.958°W	33.639°N	233.47	6.43
	Compton [0]		15.29	7.27	1.17	118.043°W	33.702°N	279.77	3.30
	Palos Verdes [6]		25.96	7.29	2.10	118.134°W	33.567°N	240.77	1.65
	Whittier alt 1 [2]		26.95	7.59	1.92	117.749°W	33.893°N	28.85	1.40
	Newport-Inglewood (Offshore) [0]		10.27	6.50	1.60	117.915°W	33.591°N	192.91	1.30
UC33brAvg_FM31 (opt)		Grid							21.16
	PointSourceFinite: -117.890, 33.703		5.71	5.61	1.17	117.890°W	33.703°N	0.00	4.77
	PointSourceFinite: -117.890, 33.703		5.71	5.61	1.17	117.890°W	33.703°N	0.00	4.77
	PointSourceFinite: -117.890, 33.757		8.95	5.94	1.54	117.890°W	33.757°N	0.00	1.58
	PointSourceFinite: -117.890, 33.757		8.95	5.94	1.54	117.890°W	33.757°N	0.00	1.58
	PointSourceFinite: -117.890, 33.766		10.17	5.77	1.76	117.890°W	33.766°N	0.00	1.06
	PointSourceFinite: -117.890, 33.766		10.17	5.77	1.76	117.890°W	33.766°N	0.00	1.06
UC33brAvg_FM32 (opt)		Grid							20.88
	PointSourceFinite: -117.890, 33.703		5.73	5.60	1.18	117.890°W	33.703°N	0.00	4.60
	PointSourceFinite: -117.890, 33.703		5.73	5.60	1.18	117.890°W	33.703°N	0.00	4.60
	PointSourceFinite: -117.890, 33.757		8.97	5.93	1.54	117.890°W	33.757°N	0.00	1.59
	PointSourceFinite: -117.890, 33.757		8.97	5.93	1.54	117.890°W	33.757°N	0.00	1.59
	PointSourceFinite: -117.890, 33.766		10.19	5.76	1.77	117.890°W	33.766°N	0.00	1.10
	PointSourceFinite: -117.890, 33.766		10.19	5.76	1.77	117.890°W	33.766°N	0.00	1.10

Leighton

Jun 2024

[illegible]

Boring Location Coordinates	
X (ft)	Y (ft)
30.8	176.3
87.4	227.8

$a_{\max} = 0.61g$
 $M_W = 7.69$
 MSF eq: 1
 $MSF = 0.94$
 Hammer Efficiency = 84
 $C_E = 1.40$
 $C_B = 1$
 C_S for SPT? TRUE
 Unlined, but room for liner
 Rod Stickup (feet) = 3
 Ring sample correction = 0.65

Summary of Liquefaction Susceptibility Analysis: SPT Method

Leighton

Liquefaction Method: Youd and Idriss (2001). Seismic Settlement Method: Tokimatsu and Seed (1987) and Martin and Lew (1999).

Project: Costa Mesa FS No. 2; Case 1; PGAm 0.614; design GW 20; No overex 0

Project No.: 24475

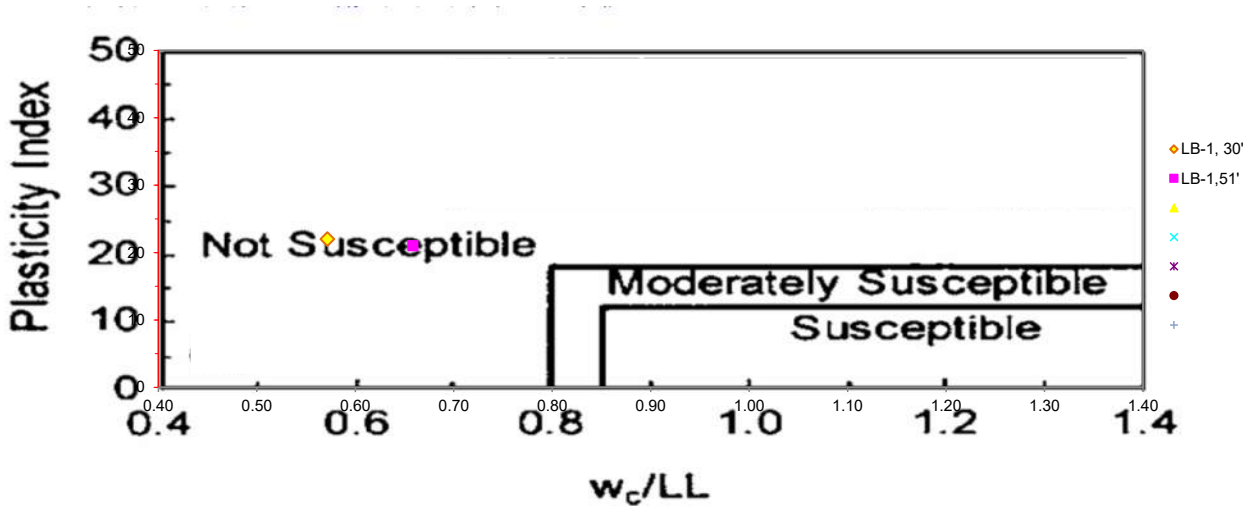
Boring No.	Approx. Layer Depth	SPT Depth	Approx Layer Thickness	Plasticity ("n"=non susc. to liq.)	Estimated Fines Cont	γ_t	N_m or B	Sampler Type (enter 2 if mod CA Ring)	N_m (corrected for Cs and ring->SPT)	Exist σ_{vo}'	$(N_1)_{60}$	$(N_1)_{60CS}$	$CRR_{7.5}$	Design			Liquefaction Factor of Safety	$(N_1)_{60CS}$ (for Settlement)	Dry Sand Strain (%) (Tok/ Seed 87)	Sat Sand Strain (%) (Tok/ Seed 87)	Seismic Sett. of Layer	Cummulative Seismic Settlement	
														σ_{vo}'	CSR _{7.5}	CSR _M							
	(ft)	(ft)	(ft)		(%)	(pcf)	(blows/ft)		(blows/ft)	(psf)				(psf)			(blows/ft)	(%)	(%)	(in.)	(in.)		
LB-1	0 to 3.8	2.5	3.8		65	120	40	2	1	26.0	300	46.4	60.7	>Range	300	0.40	0.42	NonLiq	60.7	0.01		0.00	0.1
LB-1	3.8 to 6.3	5	2.5		65	120	41	2	1	26.7	600	47.6	62.1	>Range	600	0.39	0.42	NonLiq	62.1	0.01		0.00	0.1
LB-1	6.3 to 8.8	7.5	2.5		50	120	23	2	1	15.0	900	25.5	35.6	>Range	900	0.39	0.42	NonLiq	35.6	0.06		0.02	0.1
LB-1	8.8 to 11.3	10	2.5		25	120	29	2	1	18.9	1200	29.6	37.3	>Range	1200	0.39	0.42	NonLiq	37.3	0.09		0.03	0.1
LB-1	11.3 to 13.8	12.5	2.5		75	120	39	2	1	25.4	1500	35.6	47.7	>Range	1500	0.39	0.41	NonLiq	47.7	0.03		0.01	0.1
LB-1	13.8 to 17.5	15	3.8		55	120	38	2	1	24.7	1800	31.7	43.0	>Range	1800	0.39	0.41	NonLiq	43.0	0.02		0.01	0.0
LB-1	17.5 to 20.0	20	2.5		55	120	16	1	1.25	19.9	2400	24.7	34.7	>Range	2400	0.38	0.41	NonLiq	34.7	0.10		0.03	0.0
LB-1	20.0 to 22.5	20	2.5		55	120	16	1	1.25	19.9	2400	24.7	34.7	>Range	2400	0.38	0.41	NonLiq	34.7			0.00	0.0
LB-1	22.5 to 27.5	25	5.0		50	120	46	2	1	29.9	2938	33.5	45.2	>Range	2688	0.42	0.45	NonLiq	45.2			0.00	0.0
LB-1	27.5 to 32.5	30	5.0	n	79	120	11	1	1.14	12.5	3226	14.1	22.0	>Range	2976	0.45	0.48	NonLiq	22.0			0.00	0.0
LB-1	32.5 to 37.5	35	5.0		75	120	37	2	1	24.1	3514	26.0	36.1	>Range	3264	0.46	0.49	NonLiq	36.1			0.00	0.0
LB-1	37.5 to 42.5	40	5.0		10	120	58	1	1.3	75.4	3802	78.2	80.8	>Range	3552	0.46	0.49	NonLiq	80.8			0.00	0.0
LB-1	42.5 to 47.5	45	5.0		10	120	100	2	1	65.0	4090	65.0	67.3	>Range	3840	0.45	0.48	NonLiq	67.3			0.00	0.0
LB-1	47.5 to 52.0	50	4.5	n	90	120	17	1	1.2	20.3	4378	19.7	28.6	>Range	4128	0.44	0.47	NonLiq	28.6			0.00	0.0
LB-2	0 to 3.8	2.5	3.8		55	120	37	2	1	24.1	300	42.9	56.5	>Range	300	0.40	0.42	NonLiq	56.5	0.01		0.00	0.1
LB-2	3.8 to 6.3	5	2.5		65	120	52	2	1	33.8	600	60.3	77.4	>Range	600	0.39	0.42	NonLiq	77.4	0.01		0.00	0.1
LB-2	6.3 to 8.8	7.5	2.5		65	120	26	2	1	16.9	900	28.8	39.6	>Range	900	0.39	0.42	NonLiq	39.6	0.07		0.02	0.1
LB-2	8.8 to 11.3	10	2.5		65	120	22	2	1	14.3	1200	22.4	31.9	>Range	1200	0.39	0.42	NonLiq	31.9	0.16		0.05	0.1
LB-2	11.3 to 13.8	12.5	2.5		65	120	35	2	1	22.8	1500	31.9	43.3	>Range	1500	0.39	0.41	NonLiq	43.3	0.06		0.02	0.1
LB-2	13.8 to 17.5	15	3.8		55	120	22	1	1.3	28.6	1800	36.7	49.0	>Range	1800	0.39	0.41	NonLiq	49.0	0.07		0.03	0.0
LB-2	17.5 to 20.0	20	2.5		45	120	50	2	1	32.5	2400	40.3	53.4	>Range	2400	0.38	0.41	NonLiq	53.4	0.03		0.01	0.0
LB-2	20.0 to 22.5	20	2.5		45	120	50	2	1	32.5	2400	40.3	53.4	>Range	2400	0.38	0.41	NonLiq	53.4			0.00	0.0
LB-2	22.5 to 27.5	25	5.0		45	120	20	1	1.29	25.8	2938	28.9	39.7	>Range	2688	0.42	0.45	NonLiq	39.7			0.00	0.0
LB-2	27.5 to 32.0	30	4.5		65	120	29	2	1	18.9	3226	21.2	30.5	>Range	2976	0.45	0.48	NonLiq	30.5			0.00	0.0

Plasticity and Liquefaction Susceptibility (based on Bray and Sancio, 2006)

Leighton

Costa Mesa FS No. 2; Case 1; PGAm 0.614; design GW 20; No overex 0
24475
Jun 2024

<u>Boring depth</u>	<u>USCS</u>	<u>Fines Content</u>	<u>Moisture content, Wc (%)</u>	<u>Liquid Limit, LL</u>	<u>Plasticity Index, PI</u>	<u>wc/LL</u>	<u>Preliminary Susceptibility (considering only plasticity, not consistency)</u>	<u>Susceptibility, ignoring in situ moisture content</u>
LB-1, 30'	CL	79	24	42	22	0.57	Not Susceptible	Not Susceptible
LB-1,51'	CL	90	27	41	21	0.658537	Not Susceptible	Not Susceptible



Reference:

Bray, J.D., and Sancio, R.B., 2006, Assessment of the Liquefaction Susceptibility of Fine-Grained Soils, Journal of Geotechnical and Geoenvironmental Engineering, American Society of Civil Engineers, Vol. 132, No. 9, dated September 1, 2006, pp. 1165-1177.



APPENDIX D

GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

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LEIGHTON CONSULTING, INC.

GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

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C - Canyon Subdrains	Rear of Text
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E - Transition Lot Fills and Side Hill Fills	Rear of Text

LEIGHTON CONSULTING, INC.
General Earthwork and Grading Specifications

1.0 General

- 1.1 Intent: These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).
- 1.2 The Geotechnical Consultant of Record: Prior to commencement of work, the owner shall employ the Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultants shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all key bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to determine the attained level of compaction. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

- 1.3 The Earthwork Contractor: The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The

Contractor shall be solely responsible for performing the grading in accordance with the plans and specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified.

2.0 Preparation of Areas to be Filled

- 2.1 Clearing and Grubbing: Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent of organic matter. Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

- 2.2 Processing: Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.
- 2.3 Overexcavation: In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.
- 2.4 Benching: Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.
- 2.5 Evaluation/Acceptance of Fill Areas: All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

- 3.1 General: Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.
- 3.2 Oversize: Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.
- 3.3 Import: If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

- 4.1 Fill Layers: Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.
- 4.2 Fill Moisture Conditioning: Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557-91).

- 4.3 Compaction of Fill: After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557-91). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.
- 4.4 Compaction of Fill Slopes: In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557-91.
- 4.5 Compaction Testing: Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).
- 4.6 Frequency of Compaction Testing: Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.
- 4.7 Compaction Test Locations: The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 Safety: The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

7.2 Bedding and Backfill: All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.3 Lift Thickness: Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

7.4 Observation and Testing: The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

APPENDIX E

GBA'S IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT

Important Information about This Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be, and, in general, if you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying it.* A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may

perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old*.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration*. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists*.



Telephone: 301/565-2733

e-mail: info@geoprofessional.org www.geoprofessional.org