FUSCOE ENGINEERING

PRELIMINARY WATER QUALITY MANAGEMENT PLAN (PWQMP)

VICTORIA APARTMENTS

CITY OF DANA POINT, CA

PREPARED FOR
TOLL BROTHERS APARTMENT LIVING
23422 Mill Creek Drive, Suite 105
Laguna Hills, CA 92653
949.573.7300

REGISTERED PROFESSIONAL ENGINEER
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CIVIL
STATE OF CALIFORNIA

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DATE LAST PREPARED: March 9, 2022
DATE REVISED: June 30, 2023

PROJECT NUMBER: 1665-004-01

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PRELIMINARY
Water Quality Management Plan (WQMP)
Project Name:
VICTORIA APARTMENTS

CITY OF DANA POINT
Tract No. 735
26126 Victoria Boulevard, Dana Point, CA 92624
APN 668-361-01

Prepared for:

TOLL BROTHERS APARTMENT LIVING
23422 Mill Creek Drive, Suite 105
Laguna Hills, CA 92653
949.573.7300

Prepared by:

FUSCOE ENGINEERING, INC.

Engineer: Shelby Shirlock, PE
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Engineer's Seal

Prepared on:

February 28, 2020

Revised On:

May 28, 2020
May 7, 2021
June 16, 2021
March 9, 2022
July 27, 2022

June 30, 2023

PROJECT OWNER'S CERTIFICATION			
Permit/Application No.	PA19-0058	**Grading Permit No.**	Pending
Tract/Parcel Map No.	Tract No. 735	**Building Permit No.**	Pending
Address of Project Site and/or APN (Specify Lot Numbers if Portions of Tract)		26126 Victoria Boulevard, Dana Point, CA 92624 APN: 668-361-01	

This Water Quality Management Plan (WQMP) has been prepared for Toll Brothers Apartment Living by Fuscoe Engineering, Inc. The WQMP is intended to comply with the requirements of the local 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 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 San Diego Region (South Orange County).. 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: John Hyde			
Title:	Senior Project Manager		
Company:	Toll Brothers Apartment Living		
Address:	23422 Mill Creek Drive, Suite 105, Laguna Hills, CA 92653		
Email:	jhyde@tollbrothers.com		
Telephone #	949.573.7300		
Owner Signature:	John Hyde	**Date:**	6-29-23

CONTENTS

LIST OF ATTACHMENTS

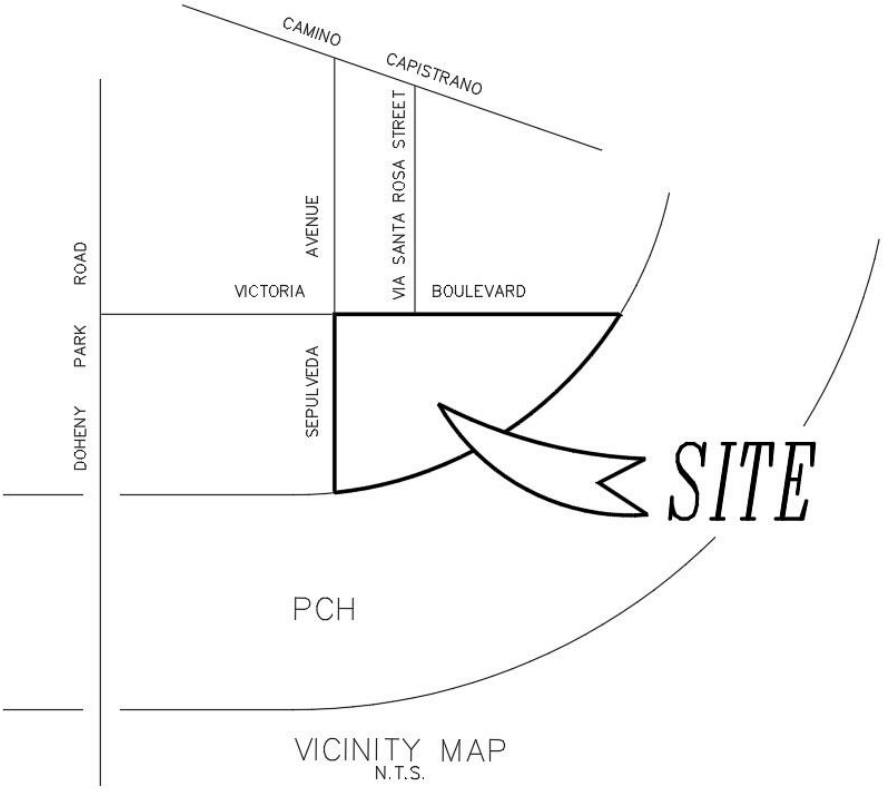
LIST OF EXHIBITS (INCLUDED IN ATTACHMENT C)

SECTION 1 DISCRETIONARY PERMIT(S) AND WATER QUALITY CONDITIONS

PROJECT INFORMATION			
Permit/Application No.	PA19-0058	**Site Address Tract/Parcel Map No.**	26126 Victoria Boulevard Dana Point, CA 92624 Tract No. 735
Additional Information/ Comments	The project is located on the southeast corner of Victoria Blvd and Sepulveda Ave in the City of Dana Point.		
WATER QUALITY CONDITIONS OF APPROVAL OR ISSUANCE			
Discretionary Permit(s):	ENG19-0462		
Water Quality Conditions from prior approvals or applicable watershed-based plans	*Pending – To be provided in Final WQMP* *City of Dana Point Water Quality Requirements for Development Projects* *All priority projects shall meet Water Quality Management Plan (WQMP) and Hydromodification Management Plan (HMP) requirements as described in the documents and tools below. The project's WQMP is a plan for minimizing the adverse effects of urbanization on site hydrology, runoff flow rates and pollutant loads. Hydromodification management measures address the changes in the magnitude and frequency of stream flows and associated sediment load due to urbanization or other changes in the watershed land use and hydrology and the resulting impacts on receiving channels, such as erosion, sedimentation and potentially degradation of in-stream habitat.* *Note: The Preliminary WQMP (pWQMP) is required as part of the Project Application. An application will not be deemed complete without a pWQMP. It should be noted that the pWQMP is not a "conceptual" document in the normal sense of the word and requires detailed engineering sizing calculations and location details for selected BMPs.*		

SECTION 2 PROJECT DESCRIPTION

2.1 PROJECT DESCRIPTION

<table>
<tr><th colspan="3">DESCRIPTION OF PROPOSED PROJECT</th></tr>
<tr><td>Site Location:</td><td colspan="2">The project is located at 26126 Victoria Boulevard, Dana Point, CA 92624. The project is bounded by Victoria Blvd to the northeast, Sepulveda Ave to the northwest and La Playa Ave and Pacific Coast Highway (PCH) to the south.
 
</td></tr>
<tr><td>Project Area (ft^2):
240,263 ft^2</td><td>Number of Dwelling Units: 306</td><td>SIC Code: N/A</td></tr>
<tr><td>Narrative Project Description:</td><td colspan="2">The project site is currently developed and being utilized as a storage facility. Existing buildings and parking lots will be demolished and replaced with a 2 to 5-story on-grade wrap-style luxury apartment community which will wrap around a 6.5-level parking structure. The parking structure will provide 524 residential spaces and 62 visitor spaces for a total of 586 parking spaces. The apartment complex will consist of 36 studios, 153 one-bedroom units, 105 two-bedroom units, and 12 three-bedroom units for a total of 306 dwelling units.</td></tr>
</table>

DESCRIPTION OF PROPOSED PROJECT				
	The proposed residential building will include a leasing office, lobby, bike spa, and boardwalk storage room in the western/southwestern portion of the building. Six outdoor courtyards are proposed surrounding the proposed amenities. In addition, roof deck amenities that will include a pool & spa are proposed. All details are subject to change and will be finalized in the Final WQMP. Outdoor activities are anticipated with passive uses in the common landscaped areas surrounding the building, within the proposed courtyard/amenity areas, for recreational and open space purposes. All vehicular parking will be located in the proposed parking structure. No outdoor storage of materials is anticipated. All other outdoor areas will be used for walkways, common areas and landscaping, and other passive recreational purposes. No outdoor storage of materials is anticipated (materials will be stored indoors). Materials anticipated to be stored on-site include those associated with residential developments (i.e. cleaning products, storage, etc.); however, no hazardous wastes will be stored on-site. Trash will be managed indoors by one trash room in the ground-level parking structure. An at-grade trash staging area will be located next to the parking structure entrance on the southerly portion of the parking structure. Outdoor trash receptacles will be provided throughout the common areas of the site for the tenants to dispose of their refuse in a proper manner, and property maintenance will provide trash and waste material removal to maintain a trash-free property. All wastes shall be collected and properly disposed of off-site. The site is not anticipated to have any loading docks, outdoor storage areas, community car wash racks, equipment wash areas, or food preparation areas associated with food service establishments. A pet spa/wash area will be provided indoors in the southern portion of the proposed residential building and will be plumbed to sewer. The proposed rooftop pool & spa will also drain to sewer. Additional details on these proposed features will be provided in the Final WQMP). The potential stormwater or urban runoff pollutants reasonably expected to be associated with the project include Suspended Solids, Nutrients, Bacteria/Virus/Pathogens, Pesticides, Oil and Grease, Trash and Debris, and Dry Weather Runoff.			
Project Area	**Pervious**		**Impervious**	
	Area (acres or sq ft)	**Percentage**	**Area (acres or sq ft)**	**Percentage**
Pre-Project Conditions	0.55	10%	4.97	90%

DESCRIPTION OF PROPOSED PROJECT				
Post-Project Conditions	0.62	11%	4.90	89%

2.2 POST-DEVELOPMENT DRAINAGE CHARACTERISTICS

Under proposed conditions, runoff will follow existing drainage patterns. A proposed storm drain system will route low flows to one of seven Modular Wetland Systems (MWS) for water quality treatment while high flows by-pass the system. Both treated and high flows will tie into an existing 30" or 36" storm drain system, exiting the site along Sepulveda Ave and Victoria Blvd. The drainage is then conveyed by a public storm drain system to the San Juan Creek, an Orange County Flood Control District (OCFCD) Channel, and ultimately out to the Pacific Ocean. Runoff from the adjacent 1 Freeway slope in the southern portion of the project site will be diverted around the site via new gutter and will continue to drain to Sepulveda Ave similar to existing conditions.

2.3 PROPERTY OWNERSHIP/MANAGEMENT

PROPERTY OWNERSHIP/MANAGEMENT	
Public Streets	City of Dana Point
Private Streets	Toll Brothers Apartment Living
Landscaped Areas	Toll Brothers Apartment Living
Buildings	Toll Brothers Apartment Living
Storm Drain	Toll Brothers Apartment Living
Structural BMPs	Toll Brothers Apartment Living

The Owner, Toll Brothers Apartment Living, shall assume all BMP maintenance and inspection responsibilities for the proposed project. Inspection and maintenance responsibilities are outlined in Attachment B of this report.

SECTION 3 SITE & WATERSHED CHARACTERIZATION

3.1 SITE CONDITIONS

3.1.1 Existing Site Conditions

The project site is currently developed and being utilized as a storage facility. It is also being used as bus parking for the Capistrano Unified School District and consists of surface parking lots, along with various school district maintenance and facility buildings. The address is 26126 Victoria Boulevard Dana Point, CA 92624 (APN 668-361-01). The surrounding development includes churches to the west, a fire station to the east, an existing mobile home park to the north as well as commercial development to the northeast. Per the City of Dana Point General Plan, the site's land use is Community Facility and is zoned CF (Community Facility).

The existing site has varying elevations with the highest point located at the easterly corner and lowest point near the westerly corner of the site. The site drainage mostly flows in a south westerly direction. Runoff sheet flows across the site in that southerly direction and discharges onto Sepulveda Ave. This portion of Sepulveda Ave. also receives runoff from an offsite portion of the 1 freeway slope. From there, drainage flows along Sepulveda Ave until it is intercepted by a catch basin and culvert near the southwest corner of the property. The drainage is then conveyed by a public storm drain system to the San Juan Creek, an Orange County Flood Control District (OCFCD) Channel, and ultimately out to the Pacific Ocean.

The existing storm drain system begins as a 21" RCP at the upstream reach, near the intersection of Victoria Boulevard and Camino Capistrano. The storm drain continues as a 24" RCP westerly on Victoria Boulevard, toward Sepulveda Avenue, where it becomes a 30" RCP. The storm drain then turns southerly on Sepulveda Avenue, where it becomes a 36" RCP before discharging into a headwall at the south end of Sepulveda Avenue. Based on the topography of the site, it appears that the property is tributary to this storm drain system.

EXISTING LAND USES				
Land Use Description	**Total Area (acres)**	**Impervious Area (acres)**	**Pervious Area (acres)**	**Imperviousness (%)**
Commercial	5.52	4.97	0.55	90
Total	5.52	4.97	0.55	90

3.1.2 Infiltration-Related Characteristics

3.1.2.1 Hydrogeologic Conditions

Groundwater was encountered approximately 16 to 20 feet below the existing ground surface during a field investigation conducted by Geocon West, Inc. in March 2019. Review of the Seismic Hazard Zone Report for the Dana Point 7.5 Minute Quadrangle (California Division of Mines and Geology [CDMG], 2001) indicates the historically highest groundwater level in the area is approximately 5 feet beneath

the ground surface. The Geotech report advises, "Considering the historic high groundwater level and the depth to groundwater observed in the borings, groundwater may be encountered during construction. It is not uncommon for groundwater levels to vary seasonally or for groundwater seepage conditions to develop where none previously existed, especially in impermeable fine-grained soils which are heavily irrigated or after seasonal rainfall."

3.1.2.2 Soil and Geologic Infiltration Characteristics

The geotechnical investigation, performed by Geocon West, Inc. in March 2019, found the site is underlain with artificial fill, Holocene age stream alluvial deposits, and by late Miocene to early Pliocene Capistrano Formation. The artificial fill was encountered to a maximum depth of 5 feet below ground surface (bgs) and consist of brown, gray brown, and reddish brown, sandy silty clay, clayey silt, and clayey silty sand. It is noted that there was previously abandoned underground storage tanks onsite that were removed from the northeast corner of the site. The backfill material for these excavations is classified as undocumented artificial fill. Alluvial deposits were found underneath the fill and consist of brown to dark brown to gray to olive brown, interbedded sandy clayey silt, silty clay, and clayey sand. Capistrano Formation was encountered at depths of approximately 40, 25, and 35 feet bgs. Where encountered, the bedrock consists of clayey and sandy siltstone and silty sandstone. In general, the unit generally consists of a stiff to hard siltstone to claystone that is highly expansive.

According to Figure 9.9a of the TGD, the project site is partially located in Hydrologic Soil Group (HSG) D soils (see Attachment C). The figure below from the Web Soil Survey shows the estimated boundary of the HSG D soils (Map Unit Symbol 102).

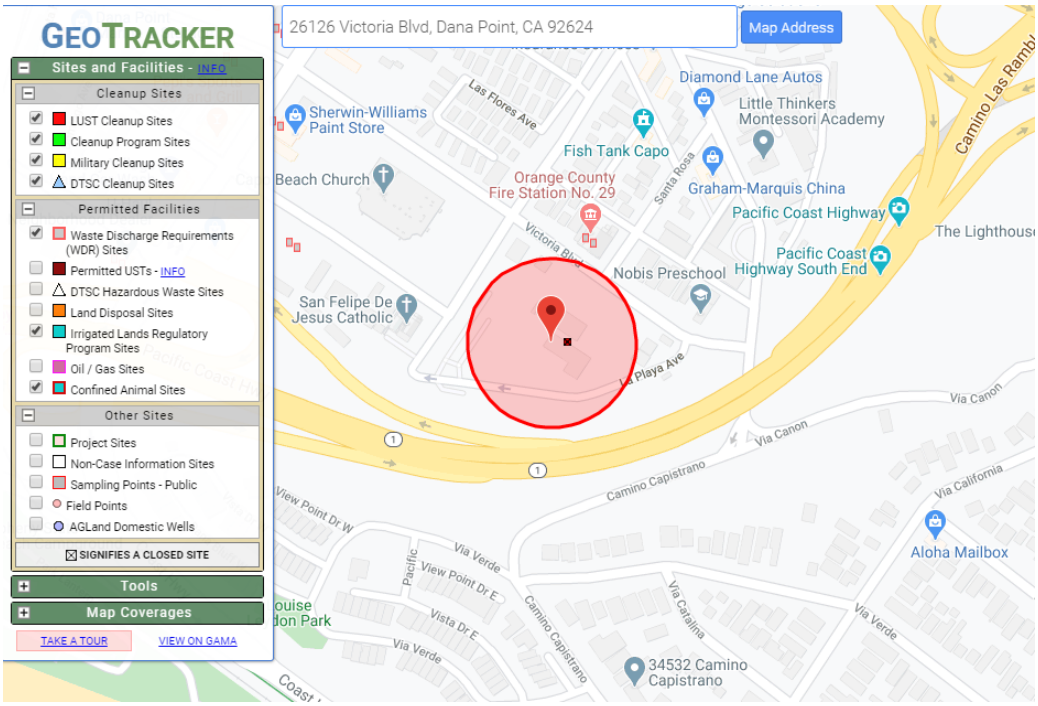
Map Unit Legend

Orange County and Part of Riverside County, California (CA678)

Orange County and Part of Riverside County, California (CA678)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
102	Alo clay, 30 to 50 percent slopes, warm MAAT, MLRA 20	1.8	29.2%
206	Sorrento loam, 0 to 2 percent slopes, warm MAAT, MLRA 19	1.9	31.4%
207	Sorrento loam, 2 to 9 percent slopes, warm MAAT, MLRA 19	2.4	39.4%
Totals for Area of Interest		**6.1**	**100.0%**

There is a LUST Cleanup Site within 250 feet of the project site. CUSD Transportation Yard (T0605902398) was discovered to have leaking underground storage tanks and was reported in December of 1989. The main contaminant of concern was gasoline and it posed a threat to other groundwater (uses other than drinking water such as municipal, agricultural, and industrial). The petroleum release was remediated and the case was closed as of July 26, 2000.



3.1.2.3 Geotechnical Conditions

Overall, the geotechnical conditions of the project site are not favorable to infiltration. In addition to poor infiltrating soils, the State of California Seismic Hazard Zone Map for the Dana Point Quadrangle (CDMG, 2001) indicates that the site is located within an area designated as having a potential for liquefaction, mostly likely due to shallow groundwater levels, a primary factor controlling liquefaction. Liquefaction is a phenomenon in which loose, saturated, relatively cohesionless soil deposits lose shear strength during strong ground motions.

The topography at the site is relatively flat with no pronounced highs or lows. Offsite slopes bounding the southwestern portion of the property range from 12 feet on the southwest to 45 feet at the northeast corner. This offsite drainage will be diverted around the project via concrete v-gutter.

The site is not located within an area identified as having a potential for seismic slope instability (CDMG, 2001). There are no known landslides near the site, nor is the site in the path of any known or potential landslides. Therefore, the potential for slope stability hazards to adversely affect the proposed development is considered low.

The site is located within a coastal area and therefore, tsunamis, seiches, and flooding are considered possible geologic hazards in the site vicinity. The site is not located within the tsunami inundation area (CEMA, 2009), therefore, the risk of tsunami inundation is considered unlikely.

3.1.2.4 Summary of Infiltration Opportunities and Constraints of Existing Site

Full and partial infiltration is considered infeasible on the project site due to several limiting site conditions. According to Section 4.2.2.3 of the TGD, full and partial infiltration of the DCV is prohibited if seasonally high groundwater or mounded groundwater is less than 5 feet below the designed bottom of the infiltration facility. As stated in Section 3.1.2.1, seasonally high groundwater is 5 feet below ground surface making infiltration infeasible.

In addition to shallow groundwater and clayey soils, the site is also subject to liquefaction. Section 4.2.2.4 notes that full infiltration in locations less than 50 feet away from slopes steeper than 15 percent poses a significant risk. Variable slopes are present offsite and border the project site to the south east.

Lastly, Geotracker found past contamination onsite. Although the case has been closed, past contamination and shallow groundwater are major concerns for implementing infiltration BMPs and potentially contaminating groundwater. Full and partial infiltration has been deemed infeasible. BMPs will be designed as biotreatment with no infiltration.

3.2 PROPOSED SITE DEVELOPMENT ACTIVITIES

The Development Area – that is the area to be disturbed within project grading limits – encompasses approximately 5.52 acres that is currently existing commercial buildings and parking lots to be demolished and replaced with the proposed residential building, landscaped areas and walkways. The proposed building will consist of two to five stories of dwelling units above ground wrapped around a six and half story parking garage. The building includes approximately 306 proposed residential units with roughly 586 parking stalls for tenants and guests. A total of approximately 4.69 acres of the

property will end up as impervious surface, resulting in a proposed imperviousness of 89%. Additional details will be provided in the Final WQMP.

3.2.1 Overview of Site Development Activities

The proposed development of the project site involves the demolition of the existing buildings and parking lots and the construction of a new residential building that includes residential units and an enclosed parking garage. The construction of the proposed residential building will result in slightly less impervious surface than the in the existing condition (89% impervious proposed versus 90% impervious existing). The stormwater runoff from the proposed development will end up in the same existing storm sewer system on Sepulveda Ave. as the runoff under existing conditions and will continue to enter San Juan Creek.

3.2.2. Project Attributes Influencing Stormwater Management

There are no outdoor trash enclosures on the project site as the site's trash enclosure will be located indoors within the proposed building's parking levels. No loading docks, outdoor storage areas, vehicle wash areas, or hazardous materials storage are proposed on the project site. Parking will be provided for the proposed residential building via garage parking structure. Native vegetation will be provided on the project site to minimize the amount of imperviousness proposed and minimize the potable water demands for irrigation.

PROPOSED LAND USES				
Land Use Description	Total Area (acres)	Impervious Area (acres)	Pervious Area (acres)	Imperviousness (%)
Residential	5.52	4.90	0.62	89%
Total	5.52	4.90	0.62	89%

3.2.3 Effects on Infiltration and Harvest and Use Feasibility

Harvest and reuse (a.k.a. Rainwater Harvesting) BMPs are LID BMPs that capture and store storm water runoff for later se. Per Section 4.2.3 of the South OC TGD, projects are required to consider harvest and use if the reliable wet season demand for harvest water is adequate to use the DCV (Design Capture Volume) within 48 hours.

In order to quantify harvested water demand for the common area of the project, the Modified Estimate Applied Water Use (EAWU) method was used, consistent with Appendix F of the South OC TGD (dated September 28, 2017).

The Modified EAWU method is modified from the OC Irrigation Code (County Ordinance No. 09-010) to account for the wet season demand and storm events (assuming that no irrigation would be applied for approximately 30% of the days in the wet season).

The equation used to calculate the Modified EAWU is:

$$Modified\ EAWU = \frac{(ETo_{wet} \times K_L \times LA \times 0.015)}{IE}$$

Where:

$Modified\ EAWU$ = estimated daily average water use during wet season
ETo_{wet} = average reference ET from November through April (inches per month) per Table F-2 of the TGD
K_L = landscape coefficient (Table F-4 of the TGD)
LA = landscape area irrigated with harvested water (square feet)
IE = irrigation efficiency (assumed at 90%)

Note: in the equation, the coefficient (0.015) accounts for unit conversions and shut down of irrigation during and for three days following a significant precipitation event.

For a system to be considered "feasible", the reliable wet season demand for harvested water must be adequate to use the DCV within 48 hours.

The overall project site was evaluated using the impervious/pervious land area ratios and planting types to estimate the feasibility for harvest and reuse systems on-site. A Landscape Coefficient (K_L) of 0.55 was used in the calculations to represent a blend of both conservation landscape design and active turf area. The following table summarizes the estimated applied water use for the project site.

ESTIMATED APPLIED WATER USE (EAWU) FOR COMMON AREA LANDSCAPING

Drainage Area & Landscape Type	Total Area (ac)	% Imp	Imp Tributary (ac)	Irrigated LS Area (ac)	ETo_{wet}[1] (in/mo)	K_L[2]	Modified EAWU (gpd)
Blended	5.52	0.89	4.90	0.62	2.75	0.55	667
Design Capture Volume (gal)		98,082	Drawdown (days)	147	Is Drawdown of DCV <48 hours?		No

Notes:
1 Per Table F-2 for Laguna Beach (similar climate type), South OC Technical Guidance Document, September 28, 2017.
2 Per Table F-4 of the South OC Technical Guidance Document, September 28, 2017. An assumed KL of 0.55 was used to represent a blend of both conservation landscape design and active turf areas.

As shown above, the project does not have sufficient water demand during the wet season to support harvest and reuse. There is insufficient irrigation demand to drawdown the DCV in 48 hours.

3.3 RECEIVING WATERBODIES

Known 303(d) Listed pollutants for the receiving water bodies include:

- San Juan Creek: Benthic Community Effects, DDE, Indicator Bacteria, Phosphorus, Selenium, Nitrogen, Dissolved Oxygen, Toxicity
- San Juan Creek (mouth): Cadmium, Copper, Indicator Bacteria, Nickel, Ammonia

TMDLs (Total Maximum Daily Load) for the receiving water bodies include:

- San Juan Creek: Benthic Community Effects (est. 2005), DDE (est. 2005), Indicator Bacteria (est. 2005), Phosphorus (est. 2005), Selenium (est. 2005), Nitrogen (est. 2005), Dissolved Oxygen (est. 2005), Toxicity (est. 2005)
- San Juan Creek (mouth): Cadmium (est. 2005), Copper (est. 2005), Indicator Bacteria (est. 2011), Nickel (est. 2005), Nitrogen Ammonia (est. 2005)

There are no Environmentally Sensitive Areas (ESAs) or Areas of Special Biological Significance (ASBS) within the project site or within the project site's vicinity.

3.4 STORMWATER POLLUTANTS OR CONDITIONS OF CONCERN

POLLUTANTS OR CONDITIONS OF CONCERN				
Pollutant	**Expected from Proposed Land Uses/ Activities (Yes or No)**	**Receiving Waterbody Impaired? (Yes or No)**	**Priority Pollutant from WQIP or other Water Quality Condition? (Yes or No)**	**Pollutant of Concern (Primary, Other or No)**
Suspended Solids	Yes	No	No	Other
Nutrients	Yes	Yes	No	Primary
Heavy Metals	No	Yes	No	No
Bacteria/Virus/Pathogens	Yes	Yes	Yes	Primary
Pesticides	Yes	Yes	No	Primary
Oil and Grease	Yes	No	No	Other
Toxic Organic Compounds	No	Yes	No	No
Trash and Debris	Yes	No	No	Other
Dry Weather Runoff	Yes	No	Yes	Primary

3.5 HYDROLOGIC CONDITIONS OF CONCERN

Does a hydrologic condition of concern exist for this project?

☒ No – An HCOC does not exist for this receiving water because (select one):

☐ Project discharges directly to a protected conveyance (bed and bank are concrete lined the entire way from the point(s) of discharge to a receiving lake, reservoir, embayment, or the Ocean

☒ Project discharges directly to storm drains which discharge directly to a reservoir, lake, embayment, ocean or protected conveyance (as described above)

☐ The project discharges to an area identified in the WMAA as exempt from hydromodification concerns

☐ Yes – An HCOC does exist for this receiving water because none of the above are applicable.

The project will not be subject to hydromodification mitigation measures, as it discharges to San Juan Creek, which is an engineered, large river, and is exempted by the South Orange County Dana Point Exemption Map (see Attachment C).

3.6 CRITICAL COURSE SEDIMENT YIELD AREAS

Not Applicable. The project is not located in an area of high course sediment yield. Refer to the South Orange County Potential Course Sediment San Juan Creek Exhibit in Attachment C.

SECTION 4 SITE PLAN AND DRAINAGE PLAN

4.1 DRAINAGE MANAGEMENT AREA DELINEATION

In accordance with the South Orange County Model WQMP and Technical Guidance Document (TGD), the project site has been divided into Drainage Management Areas (DMAs) to be utilized for defining drainage areas and sizing LID and other treatment control BMPs. The DMAs were primarily delineated based on the building's roof drainage, as most of the project site is comprised of the building footprint. As full and partial infiltration is considered to be infeasible for the project site, seven proprietary biotreatment units are proposed throughout the site to address water quality treatment.

Runoff from DMAs 1-7 will be directed to Modular Wetland System units for water quality treatment. A diversion structure will divert low flows to the MWS unit while high flows will by-pass the system and exit onto Sepulveda Ave.

The DCVs for each DMA are summarized in the table below. These have been derived utilizing the "Simple Method" in accordance with the TG Section E.3.1. Actual BMP sizing requirements, including 80 percent capture flowrates, and other design details for the specific BMPs proposed are provided in Section 4.3 below. Locations of DMAs and associated LID and treatment BMPs are identified on the exhibits in Attachment C. Additional calculations and TGD Worksheets are provided in Attachment D.

DRAINAGE MANAGEMENT AREAS (DMAs)					
DMA	BMP	Drainage Area (ac)	% Imp.	Design Storm Depth (in)	Simple Method DCV (ft^3)
DMA 1	BIO-7: Proprietary Biotreatment	1.16	85%	0.8	2,654
DMA 2	BIO-7: Proprietary Biotreatment	0.81	85%	0.8	1,854
DMA 3	BIO-7: Proprietary Biotreatment	0.41	95%	0.8	1,028
DMA 4	BIO-7: Proprietary Biotreatment	0.33	85%	0.8	755
DMA 5	BIO-7: Proprietary Biotreatment	1.10	100%	0.8	2,875
DMA 6	BIO-7: Proprietary Biotreatment	0.74	85%	0.8	1,693
DMA 7	BIO-7: Proprietary Biotreatment	0.97	85%	0.8	2,220
Total	--	5.52	89%	0.8	13,113

4.2 OVERALL SITE DESIGN BMPS

Minimize Impervious Area

Impervious surfaces have been minimized by incorporating landscaped areas throughout the site surrounding the proposed building. Landscaping will be provided throughout the site within the common areas as well as around the perimeter of the building.

Maximize Natural Infiltration Capacity

This BMP is not applicable as the project site is not suitable for infiltration.

Preserve Existing Drainage Patterns and Time of Concentration

Runoff from the site will continue to flow similar to existing conditions. Low-flows and first-flush runoff will drain to modular wetland systems for water quality treatment via biofiltration.

Disconnect Impervious Areas

Landscaping will be provided around the perimeter of the building and in the courtyard areas. Runoff from the site will flow through proprietary biofiltration systems for water quality treatment.

Protect Existing Vegetation and Sensitive Areas

Under the existing conditions, the majority of the site has been developed and there are not existing vegetation or sensitive areas to protect.

Revegetate Disturbed Areas

All disturbed areas on the project site will either be paved or landscaped.

Soil Stockpiling and Site Generated Organics

As part of the grading and stockpiling activities on the site, organic materials that are suitable for assisting with the re-vegetation of the site will be collected, stored and then reused during planting of the site, where feasible.

Firescaping

The proposed project is designed to meet the Orange County Fire Authority's fuel modification standards.

Water Efficient Landscaping

Xeriscape landscaping is not proposed for the project. However, native and/or tolerant landscaping will be incorporated into the site design consistent with City guidelines.

Slopes and Channel Buffers

This BMP does not apply to the project site as the site is relatively flat and there are no slopes to be protected.

4.3 DMA CHARACTERISTICS AND SITE DESIGN BMPS

Following is a detailed description of each Drainage Management Area as delineated on HMP Proposed Condition and the WQMP Exhibits in Attachment C.

4.3.1 DMA 1

DMA 1 is located in the northern portion of the project site and has a total area of 1.16 acres with an assumed imperviousness of 85%. Calculations are based on this conservative impervious ratio for residential land use. This ratio is subject to change in final design with updated landscape architect plans. This drainage area will consist of walkways and seating areas in Courtyard C and D along with ornamental landscaping and building roof runoff. Runoff from this drainage area will be piped to a Modular Wetland System on the north side of the site along Victoria Blvd. Low flows will be treated via biotreatment while high flows will bypass treatment via a diversion structure. All flows will connect to the existing storm line along Victoria Blvd before draining into San Juan Creek.

4.3.2 DMA 2

DMA 2 is located in the northern portion of the project site and has a total area of 0.81 acres with an assumed imperviousness of 85%. Calculations are based on this conservative impervious ratio for residential land use. This ratio is subject to change in final design with updated landscape architect plans. This drainage area will consist of walkways and seating areas in Courtyard A and B along with ornamental landscaping and building roof runoff. Runoff from this drainage area will be piped to a Modular Wetland System on the north corner of the site along Victoria Blvd. Low flows will be treated via biotreatment while high flows will bypass treatment via a diversion structure. All flows will connect to the existing storm line along Victoria Blvd before draining into San Juan Creek.

4.3.3 DMA 3

DMA 3 is located in the south west portion of the project site and has a total area of 0.41 acres with an assumed imperviousness of 95%. Calculations are based on this conservative impervious ratio for residential land use. This ratio is subject to change in final design with updated landscape architect plans. This drainage area will consist of walkways, ornamental landscaping and building roof runoff. Runoff from this drainage area will be piped to a Modular Wetland System on the southwest side of the site along Sepulveda Ave. Low flows will be treated via biotreatment while high flows will bypass treatment via a diversion structure. All flows will connect to the existing storm line along Sepulveda Ave before draining into San Juan Creek.

4.3.4 DMA 4

DMA 4 is located in the north east portion of the project site and has a total area of 0.33 acres with an assumed imperviousness of 85%. Calculations are based on this conservative impervious ratio for residential land use. This ratio is subject to change in final design with updated landscape architect plans. This drainage area will consist of walkways, ornamental landscaping and building roof runoff. Runoff from this drainage area will be piped to a Modular Wetland System on the east side of the site

along PCH. Low flows will be treated via biotreatment while high flows will bypass treatment via a diversion structure. All flows will connect to the existing storm line along Sepulveda Ave before draining into San Juan Creek.

4.3.5 DMA 5

DMA 5 is located in the center portion of the project site and has a total area of 1.10 acres with an assumed imperviousness of 100%. Calculations are based on this conservative impervious ratio for residential land use. This ratio is subject to change in final design with updated landscape architect plans. This drainage area will consist of mostly building roof runoff. Runoff from this drainage area will be piped to a Modular Wetland System on the southeast side of the site along PCH. Low flows will be treated via biotreatment while high flows will bypass treatment via a diversion structure. All flows will connect to the existing storm line along Sepulveda Ave before draining into San Juan Creek.

4.3.6 DMA 6

DMA 6 is located in the south portion of the project site and has a total area of 0.74 acres with an assumed imperviousness of 85%. Calculations are based on this conservative impervious ratio for residential land use. This ratio is subject to change in final design with updated landscape architect plans. This drainage area will consist of walkways and seating areas in Courtyard E along with ornamental landscaping and building roof runoff. Runoff from this drainage area will be piped to a Modular Wetland System on the southwest side of the site along PCH. Low flows will be treated via biotreatment while high flows will bypass treatment via a diversion structure. All flows will connect to the existing storm line along Sepulveda Ave before draining into San Juan Creek.

4.3.7 DMA 7

DMA 7 is located in the southwest portion of the project site and has a total area of 0.97 acres with an assumed imperviousness of 85%. Calculations are based on this conservative impervious ratio for residential land use. This ratio is subject to change in final design with updated landscape architect plans. This drainage area will consist of walkways and seating areas in Courtyard F along with ornamental landscaping and building roof runoff. Runoff from this drainage area will be piped to a Modular Wetland System on the southwest side of the site along PCH. Low flows will be treated via biotreatment while high flows will bypass treatment via a diversion structure. All flows will connect to the existing storm line along Sepulveda Ave before draining into San Juan Creek.

4.3.8 DMA Summary

DRAINAGE MANAGEMENT AREAS				
DMA (Number/Description)	Total Area (acres)	Imperviousness (%)	Infiltration Feasibility Category (Full, Partial or No Infiltration)	Hydrologic Source Controls Used
DMA 1	1.16	85%	No Infiltration	None
DMA 2	0.81	85%	No Infiltration	None
DMA 3	0.41	95%	No Infiltration	None
DMA 4	0.33	85%	No Infiltration	None
DMA 5	1.10	100%	No Infiltration	None
DMA 6	0.74	85%	No Infiltration	None
DMA 7	0.97	85%	No Infiltration	None

4.4 SOURCE CONTROL BMPS

The table below indicates all BMPs to be incorporated in the project. For those designated as not applicable (N/A), a brief explanation why is provided.

NON-STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Check One		Reason Source Control is Not Applicable
		Included	Not Applicable	
N1	Education for Property Owners, Tenants & Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Not applicable. No hazardous materials will be stored on-site.
N6	Local Water Quality Permit Compliance	☐	☒	Not applicable. The City of Dana Point does not issue water quality permits.
N7	Spill Contingency Plan	☐	☒	No fueling or liquid storage facilities.
N8	Underground Storage Tank Compliance	☐	☒	No underground tanks.
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous materials will be stored on-site.
N10	Uniform Fire Code Implementation	☐	☒	Not applicable. No hazardous materials will be stored on-site.
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	No loading docks proposed.
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	No retail gasoline outlets proposed.

N1, Education for Property Owners, Tenants and Occupants

Educational materials will be provided to tenants, including brochures and restrictions to reduce pollutants from reaching the storm drain system. Examples include tips for pet care, household tips, and proper household hazardous waste disposal. Tenants will be provided with these materials by the property management prior to occupancy, and periodically thereafter. Refer to Section 7 for a list of materials available and attached to this WQMP. Additional materials are available through the County of Orange Stormwater Program website (http://ocwatersheds.com/PublicEd/) and the California Stormwater Quality Association's (CASQA) BMP Handbooks (http://www.casqa.org/resources/bmp-handbooks).

N2, Activity Restrictions

The Owner shall develop ongoing activity restrictions that include those that have the potential to create adverse impacts on water quality. Activities include, but are not limited to: handling and disposal of contaminants, fertilizer and pesticide application restrictions, litter control and pick-up, and vehicle or equipment repair and maintenance in non-designated areas, as well as any other activities that may potentially contribute to water pollution.

N3, Common Area Landscape Management

Management programs will be designed and implemented by the Owner to maintain all the common areas within the project site. These programs will cover how to reduce the potential pollutant sources of fertilizer and pesticide uses, utilization of water-efficient landscaping practices and proper disposal of landscape wastes by the owner/developer and/or contractors.

N4, BMP Maintenance

The Owner will be responsible for the implementation and maintenance of each applicable non-structural BMP, as well as scheduling inspections and maintenance of all applicable structural BMP facilities through its staff, landscape contractor, and/or any other necessary maintenance contractors. Details on BMP maintenance can be found in the O&M Plan, Attachment B of this WQMP.

N11, Common Area Litter Control

The Owner will be responsible for performing trash pickup and sweeping of littered common areas on a weekly basis or whenever necessary. Responsibilities will also include noting improper disposal materials by the public and reporting such violations for investigation.

N12, Employee Training

All employees of the Owner and any contractors will require training to ensure that employees are aware of maintenance activities that may result in pollutants reaching the storm drain. Training will include, but not be limited to, spill cleanup procedures, proper waste disposal, housekeeping practices, etc.

N14, Common Area Catch Basin Inspection

All on-site catch basin inlets and drainage facilities shall be inspected and maintained by the Owner at least once a year, prior to the rainy season, no later than October 1st of each year.

N15, Street Sweeping Private Streets and Parking Lots

The Owner shall be responsible for sweeping all on-site drive aisles within the project on a quarterly basis.

The table below indicates all structural source control BMPs to be incorporated in the project. For those designated as not applicable (N/A), a brief explanation why is provided.

STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Check One		Reason Source Control is Not Applicable
		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 proposed.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☐	☒	Trash enclosure will be located indoors within the parking levels.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☐	☒	No slopes on site.
Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)				
S6	Dock areas	☐	☒	No loading docks are proposed.
S7	Maintenance bays	☐	☒	No maintenance bays are proposed.
S8	Vehicle wash areas	☐	☒	No vehicle wash areas are proposed.
S9	Outdoor processing areas	☐	☒	No outdoor material storage areas are proposed.
S10	Equipment wash areas	☐	☒	No equipment wash areas are proposed.
S11	Fueling areas	☐	☒	No fueling areas are proposed.
S12	Hillside landscaping	☐	☒	Project is not located on a hillside.
S13	Wash water control for food preparation areas	☐	☒	No food preparation areas are proposed.

STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Check One		Reason Source Control is Not Applicable
		Included	Not Applicable	
S14	Community car wash racks	☐	☒	No community car wash racks are proposed.

S1, Provide storm drain system stenciling and signage

The phrase "NO DUMPING! DRAINS TO OCEAN", or an equally effective phrase approved by the City, will be stenciled on all major storm drain inlets within the project site to alert the public to the destination of pollutants discharged into storm water. Stencils shall be in place prior to release of certificate of occupancy. Stencils shall be inspected for legibility on an annual basis and re-stenciled as necessary.

S4, Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control

The Owner will be responsible for the installation and maintenance of all common landscape areas utilizing similar planting materials with similar water requirements to reduce excess irrigation runoff. The Owner will be responsible for implementing all efficient irrigation systems for common area landscaping including, but not limited to, provisions for water sensors and programmable irrigation cycles. This includes smart timers, rain sensors, and moisture shut-off valves. The irrigation systems shall be in conformance with water efficiency guidelines. Systems shall be tested twice per year, and water used during testing/flushing shall not be discharged to the storm drain system.

SECTION 5 LOW IMPACT DEVELOPMENT BMPS

5.1 LID BMPS IN DMA 1

5.1.1 Hydrologic Source Controls for DMA 1

Hydrologic Source Controls (HSC) are not proposed for DMA 1. The DCV for DMA 1 is addressed through a structural LID BMP (BIO-7: Proprietary Biotreatment).

5.1.2 Structural LID BMP for DMA 1

STRUCTURAL LID BMP FOR DMA 1	
Infiltration Feasibility	*Not feasible. See Section 3.1.2*
Harvest and Use Feasibility	*Not feasible. See Section 3.2.3*
Selected BMP	BIO-7: Proprietary Biotreatment
Selected BMP Sizing Method	Stormwater Quality Design Flow (SQDF, Q_{DESIGN})
DCV	DCV = C x d x A x 43560 sf/ac x 1/12 ft/in Where: DCV = design storm capture volume, cu-ft C = runoff coefficient = (0.75 x imp + 0.15) Imp = impervious fraction of drainage area (ranges from 0 to 1) d = storm depth (inches) A = tributary area (acres) Imp = 0.85 d = 0.80 inches A = 1.16 DCV = *(0.75 x 0.85 +0.15) x 0.80 inches x 1.16 ac x 43560 sf/ac x 1/12 ft/in* = 2,654 cu-ft
$Q_{80\%}$	$Q_{80\%}$= C x I x A Where:

	$Q_{80\%}$ = flow rate to achieve 80% capture, cfs C = runoff coefficient = (0.75 x imp + 0.15) I = Rainfall Intensity (in/hr) A = tributary area (acres) I = 0.26 (a conservative Tc of 5 min was used) A = 1.16 **$Q_{80\%}$ =** *(0.75 x 0.85 +0.15) x 0.26 inches/hr x 1.16 ac* **= 0.238 cfs** *Refer to Attachment D for detailed calculations (Worksheet 9)*
Q_{DESIGN}	$Q_{DESIGN} = Q_{80\%}$ x 150% **Q_{DESIGN}** =0.238 cfs x 1.5 **= 0.356 cfs**
MWS Size/Model	MWS-L-8-16
Treatment Capacity	0.462 cfs

Since full/partial infiltration and harvest and reuse are considered infeasible in DMA 1, biotreatment BMPs (third priority structural LID BMPs) will be utilized on-site for water quality treatment. The project will implement a series of Modular Wetland System units for water quality treatment to treat all pollutants of concern to a medium to high level of effectiveness. The systems will include the Modular Wetlands Systems developed by Bio Clean Environmental Services, Inc. There are several advantages of the Modular Wetland System over traditional bioretention planters including the following reasons:

- Modular Wetlands are the only proprietary biotreatment device approved through the Washington State University TAPE (Technology Assessment Protocol – Ecology) program for basic storm water treatment and enhanced treatment including sediment, nutrients and heavy metals (all proposed pollutants of concern for the Upper Newport Bay). TAPE approval is based on a series of independent field studies using strict sampling criteria to validate vendor's claims. TAPE approval is considered one of the most stringent and most reliable in the country.
- Modular Wetlands have a pre-treatment chamber that is specifically designed to capture fine sediments and particulates through a series of BioMediaGREEN sponges which prohibit the fines and particulates from entering the bioretention chamber and accelerating potential clogging of the bioretention soil.

- Modular Wetland Systems are specifically designed for higher flow through treatment rates which reduce the potential for nutrient and copper leaching under more stagnant conditions (a common occurrence with planters that are left unmaintained).

Modular Wetlands by Modular Wetlands Systems, Inc. are proprietary biotreatment systems that utilize multi-stage treatment processes including screening media filtration, settling, and biofiltration. The pre-treatment chamber contains the first three stages of treatment, and includes a catch basin inlet filter to capture trash, debris, gross solids and sediments, a settling chamber for separating out larger solids, and a media filter cartridge for capturing fine TSS, metals, nutrients, and bacteria. Runoff then flows through the wetland chamber where treatment is achieved through a variety of physical, chemical, and biological processes. As storm water passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded and sequestered by the soil and plants, functioning similar to bioretention systems. The discharge chamber at the end of the unit collects treated flows and discharges back into the storm drain system.

This system was selected based on its ability to treat the project's pollutants of concerns to a medium or high effectiveness, in accordance with the Model WQMP and TGD requirements. The table below summarizes the overall treatment effectiveness for Modular Wetlands, derived from the Technical Guidance Document and testing data provided by the manufacturer. Additional details for the Modular Wetland System are included in Attachment C of this WQMP.

POLLUTANTS OF CONCERN AND PERFORMANCE RATINGS		
Pollutant of Concern [1]	**Treatment Effectiveness**	
	Bioretention System [2]	**Modular Wetlands Proprietary Bioretention Units** [3]
Oil & Grease	High	High
Trash & Debris	High	High
Oxygen Demanding Substances	N/A	N/A
Toxic Organic Compounds	Medium	N/A[4]
Primary Pollutant of Concern (303d listed impairments & TMDLs)		
Suspended Solids/Sediments	High	High
Nutrients	Low	Medium-High
Metals	High	High
Pathogens/Bacteria	Medium	Medium-High
Pesticides	N/A	N/A

Notes:
1 See Section II.2.
2 Per Table 4.2 of the Model WQMP's companion Technical Guidance Document dated December 20, 2013.
3 Based on Washington State University Technology Assessment Protocol – Ecology (TAPE) third-party independent field tests for a high-flow biotreatment system with raised under drain (Modular Wetland System-Linear). Refer to manufacturer documentation (attached) for specific removal efficiencies and source references.
4 Field and Lab Testing demonstrates 75-83% removal rates of Chemical Oxygen Demand (COD), a measure of the amount of organic pollutants commonly found in surface water. COD removals of this range would fall within the Medium-High effectiveness category.

The MWS unit for DMA 1 has been sized with Worksheet 9 of the TGD for treatment of 1.5 times the 80% capture flowrate not retained onsite by LID BMPs, per guidelines from the 2017 TGD. Refer to Worksheet 9 in Attachment D for further calculation details.

5.2 LID BMPS IN DMA 2

5.2.1 Hydrologic Source Controls for DMA 2

Hydrologic Source Controls (HSC) are not proposed for DMA 2. The DCV for DMA 2 is addressed through a structural LID BMP (BIO-7: Proprietary Biotreatment).

5.2.2 Structural LID BMP for DMA 2

STRUCTURAL LID BMP FOR DMA 2	
Infiltration Feasibility	*Not feasible. See Section 3.1.2*
Harvest and Use Feasibility	*Not feasible. See Section 3.2.3*
Selected BMP	BIO-7: Proprietary Biotreatment
Selected BMP Sizing Method	Flow-Based Compact Biofiltration
DCV	DCV = C x d x A x 43560 sf/ac x 1/12 ft/in Where: DCV = design storm capture volume, cu-ft C = runoff coefficient = (0.75 x imp + 0.15) Imp = impervious fraction of drainage area (ranges from 0 to 1) d = storm depth (inches) A = tributary area (acres) Imp = 0.85 d = 0.80 inches A = 0.81 DCV = *(0.75 x 0.85 +0.15) x 0.80 inches x 0.81 ac x 43560 sf/ac x 1/12 ft/in* = 1,854 cu-ft

$Q_{80\%}$	$Q_{80\%}$= C x I x A Where: $Q_{80\%}$ = flow rate to achieve 80% capture, cfs C = runoff coefficient = (0.75 x imp + 0.15) I = Rainfall Intensity (in/hr) A = tributary area (acres) I = 0.26 (a conservative Tc of 5 min was used) A = 0.81 $Q_{80\%}$ = *(0.75 x 0.85 +0.15) x 0.26 inches/hr x 0.81 ac* = 0.166 cfs *Refer to Attachment D for detailed calculations (Worksheet 9)*
Q_{DESIGN}	Q_{DESIGN}= $Q_{80\%}$ x 150% Q_{DESIGN} =0.166 cfs x 1.5 = 0.249 cfs
MWS Size/Model	MWS-L-8-12
Treatment Capacity	0.346 cfs

Since full/partial infiltration and harvest and reuse are considered infeasible in DMA 2, biotreatment BMPs (third priority structural LID BMPs) will be utilized on-site for water quality treatment. The project will implement a series of Modular Wetland System units for water quality treatment to treat all pollutants of concern to a medium to high level of effectiveness. The systems will include the Modular Wetlands Systems developed by Bio Clean Environmental Services, Inc. There are several advantages of the Modular Wetland System over traditional bioretention planters including the following reasons:

- Modular Wetlands are the only proprietary biotreatment device approved through the Washington State University TAPE (Technology Assessment Protocol – Ecology) program for basic storm water treatment and enhanced treatment including sediment, nutrients and heavy metals (all proposed pollutants of concern for the Upper Newport Bay). TAPE approval is based on a series of independent field studies using strict sampling criteria to validate vendor's claims. TAPE approval is considered one of the most stringent and most reliable in the country.
- Modular Wetlands have a pre-treatment chamber that is specifically designed to capture fine sediments and particulates through a series of BioMediaGREEN sponges which prohibit the

fines and particulates from entering the bioretention chamber and accelerating potential clogging of the bioretention soil.

- Modular Wetland Systems are specifically designed for higher flow through treatment rates which reduce the potential for nutrient and copper leaching under more stagnant conditions (a common occurrence with planters that are left unmaintained).

Modular Wetlands by Modular Wetlands Systems, Inc. are proprietary biotreatment systems that utilize multi-stage treatment processes including screening media filtration, settling, and biofiltration. The pre-treatment chamber contains the first three stages of treatment, and includes a catch basin inlet filter to capture trash, debris, gross solids and sediments, a settling chamber for separating out larger solids, and a media filter cartridge for capturing fine TSS, metals, nutrients, and bacteria. Runoff then flows through the wetland chamber where treatment is achieved through a variety of physical, chemical, and biological processes. As storm water passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded and sequestered by the soil and plants, functioning similar to bioretention systems. The discharge chamber at the end of the unit collects treated flows and discharges back into the storm drain system.

This system was selected based on its ability to treat the project's pollutants of concerns to a medium or high effectiveness, in accordance with the Model WQMP and TGD requirements. The table below summarizes the overall treatment effectiveness for Modular Wetlands, derived from the Technical Guidance Document and testing data provided by the manufacturer. Additional details for the Modular Wetland System are included in Attachment C of this WQMP.

POLLUTANTS OF CONCERN AND PERFORMANCE RATINGS		
Pollutant of Concern [1]	**Treatment Effectiveness**	
	Bioretention System [2]	**Modular Wetlands Proprietary Bioretention Units** [3]
Oil & Grease	High	High
Trash & Debris	High	High
Oxygen Demanding Substances	N/A	N/A
Toxic Organic Compounds	Medium	N/A[4]
Primary Pollutant of Concern (303d listed impairments & TMDLs)		
Suspended Solids/Sediments	High	High
Nutrients	Low	Medium-High
Metals	High	High
Pathogens/Bacteria	Medium	Medium-High
Pesticides	N/A	N/A

POLLUTANTS OF CONCERN AND PERFORMANCE RATINGS		
Pollutant of Concern [1]	Treatment Effectiveness	
	Bioretention System [2]	Modular Wetlands Proprietary Bioretention Units [3]

Notes:
5 See Section II.2.
6 Per Table 4.2 of the Model WQMP's companion Technical Guidance Document dated December 20, 2013.
7 Based on Washington State University Technology Assessment Protocol – Ecology (TAPE) third-party independent field tests for a high-flow biotreatment system with raised under drain (Modular Wetland System-Linear). Refer to manufacturer documentation (attached) for specific removal efficiencies and source references.
8 Field and Lab Testing demonstrates 75-83% removal rates of Chemical Oxygen Demand (COD), a measure of the amount of organic pollutants commonly found in surface water. COD removals of this range would fall within the Medium-High effectiveness category.

The MWS unit for DMA 2 has been sized with Worksheet 9 of the TGD for treatment of 1.5 times the 80% capture flowrate not retained onsite by LID BMPs, per guidelines from the 2017 TGD. Refer to Worksheet 9 in Attachment D for further calculation details.

5.3 LID BMPS IN DMA 3

5.3.1 Hydrologic Source Controls for DMA 3

Hydrologic Source Controls (HSC) are not proposed for DMA 3. The DCV for DMA 3 is addressed through a structural LID BMP (BIO-7: Proprietary Biotreatment).

5.3.2 Structural LID BMP for DMA 3

STRUCTURAL LID BMP FOR DMA 3	
Infiltration Feasibility	*Not feasible. See Section 3.1.2*
Harvest and Use Feasibility	*Not feasible. See Section 3.2.3*
Selected BMP	BIO-7: Proprietary Biotreatment
Selected BMP Sizing Method	Flow-Based Compact Biofiltration
DCV	DCV = C x d x A x 43560 sf/ac x 1/12 ft/in Where: DCV = design storm capture volume, cu-ft C = runoff coefficient = (0.75 x imp + 0.15) Imp = impervious fraction of drainage area (ranges from 0 to 1) d = storm depth (inches) A = tributary area (acres)

	Imp = 0.95 d = 0.80 inches A = 0.41 DCV = *(0.75 x 0.95 +0.15) x 0.80 inches x 0.41 ac x 43560 sf/ac x 1/12 ft/in* = 1,028 cu-ft
$Q_{80\%}$	$Q_{80\%}$= C x I x A Where: $Q_{80\%}$ = flow rate to achieve 80% capture, cfs C = runoff coefficient = (0.75 x imp + 0.15) I = Rainfall Intensity (in/hr) A = tributary area (acres) I = 0.26 (a conservative Tc of 5 min was used) A = 0.41 $Q_{80\%}$ = *(0.75 x 0.95 +0.15) x 0.26 inches/hr x 0.41 ac* = 0.092 cfs *Refer to Attachment D for detailed calculations (Worksheet 9)*
Q_{DESIGN}	Q_{DESIGN}= $Q_{80\%}$ x 150% Q_{DESIGN} =0.092 cfs x 1.5 = 0.138 cfs
MWS Size/Model	MWS-L-4-13
Treatment Capacity	0.144 cfs

Since full/partial infiltration and harvest and reuse are considered infeasible in DMA 3, biotreatment BMPs (third priority structural LID BMPs) will be utilized on-site for water quality treatment. The project will implement a series of Modular Wetland System units for water quality treatment to treat all pollutants of concern to a medium to high level of effectiveness. The systems will include the Modular

Wetlands Systems developed by Bio Clean Environmental Services, Inc. There are several advantages of the Modular Wetland System over traditional bioretention planters including the following reasons:

- Modular Wetlands are the only proprietary biotreatment device approved through the Washington State University TAPE (Technology Assessment Protocol – Ecology) program for basic storm water treatment and enhanced treatment including sediment, nutrients and heavy metals (all proposed pollutants of concern for the Upper Newport Bay). TAPE approval is based on a series of independent field studies using strict sampling criteria to validate vendor's claims. TAPE approval is considered one of the most stringent and most reliable in the country.
- Modular Wetlands have a pre-treatment chamber that is specifically designed to capture fine sediments and particulates through a series of BioMediaGREEN sponges which prohibit the fines and particulates from entering the bioretention chamber and accelerating potential clogging of the bioretention soil.
- Modular Wetland Systems are specifically designed for higher flow through treatment rates which reduce the potential for nutrient and copper leaching under more stagnant conditions (a common occurrence with planters that are left unmaintained).

Modular Wetlands by Modular Wetlands Systems, Inc. are proprietary biotreatment systems that utilize multi-stage treatment processes including screening media filtration, settling, and biofiltration. The pre-treatment chamber contains the first three stages of treatment, and includes a catch basin inlet filter to capture trash, debris, gross solids and sediments, a settling chamber for separating out larger solids, and a media filter cartridge for capturing fine TSS, metals, nutrients, and bacteria. Runoff then flows through the wetland chamber where treatment is achieved through a variety of physical, chemical, and biological processes. As storm water passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded and sequestered by the soil and plants, functioning similar to bioretention systems. The discharge chamber at the end of the unit collects treated flows and discharges back into the storm drain system.

This system was selected based on its ability to treat the project's pollutants of concerns to a medium or high effectiveness, in accordance with the Model WQMP and TGD requirements. The table below summarizes the overall treatment effectiveness for Modular Wetlands, derived from the Technical Guidance Document and testing data provided by the manufacturer. Additional details for the Modular Wetland System are included in Attachment C of this WQMP.

POLLUTANTS OF CONCERN AND PERFORMANCE RATINGS		
Pollutant of Concern [1]	**Treatment Effectiveness**	
	Bioretention System [2]	**Modular Wetlands Proprietary Bioretention Units** [3]
Oil & Grease	High	High
Trash & Debris	High	High
Oxygen Demanding Substances	N/A	N/A
Toxic Organic Compounds	Medium	N/A[4]
Primary Pollutant of Concern (303d listed impairments & TMDLs)		

POLLUTANTS OF CONCERN AND PERFORMANCE RATINGS		
Pollutant of Concern [1]	Treatment Effectiveness	
	Bioretention System [2]	Modular Wetlands Proprietary Bioretention Units [3]
Suspended Solids/Sediments	High	High
Nutrients	Low	Medium-High
Metals	High	High
Pathogens/Bacteria	Medium	Medium-High
Pesticides	N/A	N/A

Notes:
9 See Section II.2.
10 Per Table 4.2 of the Model WQMP's companion Technical Guidance Document dated December 20, 2013.
11 Based on Washington State University Technology Assessment Protocol – Ecology (TAPE) third-party independent field tests for a high-flow biotreatment system with raised under drain (Modular Wetland System-Linear). Refer to manufacturer documentation (attached) for specific removal efficiencies and source references.
12 Field and Lab Testing demonstrates 75-83% removal rates of Chemical Oxygen Demand (COD), a measure of the amount of organic pollutants commonly found in surface water. COD removals of this range would fall within the Medium-High effectiveness category.

The MWS unit for DMA 3 has been sized with Worksheet 9 of the TGD for treatment of 1.5 times the 80% capture flowrate not retained onsite by LID BMPs, per guidelines from the 2017 TGD. Refer to Worksheet 9 in Attachment D for further calculation details.

5.4 LID BMPS IN DMA 4

5.4.1 Hydrologic Source Controls for DMA 4

Hydrologic Source Controls (HSC) are not proposed for DMA 4. The DCV for DMA 4 is addressed through a structural LID BMP (BIO-7: Proprietary Biotreatment).

5.4.2 Structural LID BMP for DMA 4

STRUCTURAL LID BMP FOR DMA 4	
Infiltration Feasibility	*Not feasible. See Section 3.1.2*
Harvest and Use Feasibility	*Not feasible. See Section 3.2.3*
Selected BMP	BIO-7: Proprietary Biotreatment
Selected BMP Sizing Method	Flow-Based Compact Biofiltration
DCV	DCV = C x d x A x 43560 sf/ac x 1/12 ft/in Where:

	DCV = design storm capture volume, cu-ft C = runoff coefficient = (0.75 x imp + 0.15) Imp = impervious fraction of drainage area (ranges from 0 to 1) d = storm depth (inches) A = tributary area (acres) Imp = 0.85 d = 0.80 inches A = 0.33 **DCV =** *(0.75 x 0.85 +0.15) x 0.80 inches x 0.33 ac x 43560 sf/ac x 1/12 ft/in* **= 755 cu-ft**
$Q_{80\%}$	$Q_{80\%}$= C x I x A Where: $Q_{80\%}$ = flow rate to achieve 80% capture, cfs C = runoff coefficient = (0.75 x imp + 0.15) I = Rainfall Intensity (in/hr) A = tributary area (acres) I = 0.26 (a conservative Tc of 5 min was used) A = 0.33 **$Q_{80\%}$ =** *(0.75 x 0.85 +0.15) x 0.26 inches/hr x 0.33 ac* **= 0.068 cfs** *Refer to Attachment D for detailed calculations (Worksheet 9)*
Q_{DESIGN}	Q_{DESIGN}= $Q_{80\%}$ x 150% **Q_{DESIGN}** =0.068 cfs x 1.5 **= 0.101 cfs**
MWS Size/Model	MWS-L-4-8

Treatment Capacity	0.115 cfs

Since full/partial infiltration and harvest and reuse are considered infeasible in DMA 4, biotreatment BMPs (third priority structural LID BMPs) will be utilized on-site for water quality treatment. The project will implement a series of Modular Wetland System units for water quality treatment to treat all pollutants of concern to a medium to high level of effectiveness. The systems will include the Modular Wetlands Systems developed by Bio Clean Environmental Services, Inc. There are several advantages of the Modular Wetland System over traditional bioretention planters including the following reasons:

- Modular Wetlands are the only proprietary biotreatment device approved through the Washington State University TAPE (Technology Assessment Protocol – Ecology) program for basic storm water treatment and enhanced treatment including sediment, nutrients and heavy metals (all proposed pollutants of concern for the Upper Newport Bay). TAPE approval is based on a series of independent field studies using strict sampling criteria to validate vendor's claims. TAPE approval is considered one of the most stringent and most reliable in the country.
- Modular Wetlands have a pre-treatment chamber that is specifically designed to capture fine sediments and particulates through a series of BioMediaGREEN sponges which prohibit the fines and particulates from entering the bioretention chamber and accelerating potential clogging of the bioretention soil.
- Modular Wetland Systems are specifically designed for higher flow through treatment rates which reduce the potential for nutrient and copper leaching under more stagnant conditions (a common occurrence with planters that are left unmaintained).

Modular Wetlands by Modular Wetlands Systems, Inc. are proprietary biotreatment systems that utilize multi-stage treatment processes including screening media filtration, settling, and biofiltration. The pre-treatment chamber contains the first three stages of treatment, and includes a catch basin inlet filter to capture trash, debris, gross solids and sediments, a settling chamber for separating out larger solids, and a media filter cartridge for capturing fine TSS, metals, nutrients, and bacteria. Runoff then flows through the wetland chamber where treatment is achieved through a variety of physical, chemical, and biological processes. As storm water passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded and sequestered by the soil and plants, functioning similar to bioretention systems. The discharge chamber at the end of the unit collects treated flows and discharges back into the storm drain system.

This system was selected based on its ability to treat the project's pollutants of concerns to a medium or high effectiveness, in accordance with the Model WQMP and TGD requirements. The table below summarizes the overall treatment effectiveness for Modular Wetlands, derived from the Technical Guidance Document and testing data provided by the manufacturer. Additional details for the Modular Wetland System are included in Attachment C of this WQMP.

POLLUTANTS OF CONCERN AND PERFORMANCE RATINGS		
Pollutant of Concern [1]	Treatment Effectiveness	
	Bioretention System [2]	Modular Wetlands Proprietary Bioretention Units [3]
Oil & Grease	High	High
Trash & Debris	High	High
Oxygen Demanding Substances	N/A	N/A
Toxic Organic Compounds	Medium	N/A[4]
Primary Pollutant of Concern (303d listed impairments & TMDLs)		
Suspended Solids/Sediments	High	High
Nutrients	Low	Medium-High
Metals	High	High
Pathogens/Bacteria	Medium	Medium-High
Pesticides	N/A	N/A

Notes:
13 See Section II.2.
14 Per Table 4.2 of the Model WQMP's companion Technical Guidance Document dated December 20, 2013.
15 Based on Washington State University Technology Assessment Protocol – Ecology (TAPE) third-party independent field tests for a high-flow biotreatment system with raised under drain (Modular Wetland System-Linear). Refer to manufacturer documentation (attached) for specific removal efficiencies and source references.
16 Field and Lab Testing demonstrates 75-83% removal rates of Chemical Oxygen Demand (COD), a measure of the amount of organic pollutants commonly found in surface water. COD removals of this range would fall within the Medium-High effectiveness category.

The MWS unit for DMA 4 has been sized with Worksheet 9 of the TGD for treatment of 1.5 times the 80% capture flowrate not retained onsite by LID BMPs, per guidelines from the 2017 TGD. Refer to Worksheet 9 in Attachment D for further calculation details.

5.5 LID BMPS IN DMA 5

5.5.1 Hydrologic Source Controls for DMA 5

Hydrologic Source Controls (HSC) are not proposed for DMA 5. The DCV for DMA 5 is addressed through a structural LID BMP (BIO-7: Proprietary Biotreatment).

5.5.2 Structural LID BMP for DMA 5

STRUCTURAL LID BMP FOR DMA 5	
Infiltration Feasibility	*Not feasible. See Section 3.1.2*
Harvest and Use Feasibility	*Not feasible. See Section 3.2.3*

Selected BMP	BIO-7: Proprietary Biotreatment
Selected BMP Sizing Method	Flow-Based Compact Biofiltration
DCV	DCV = C x d x A x 43560 sf/ac x 1/12 ft/in Where: DCV = design storm capture volume, cu-ft C = runoff coefficient = (0.75 x imp + 0.15) Imp = impervious fraction of drainage area (ranges from 0 to 1) d = storm depth (inches) A = tributary area (acres) Imp = 1.0 d = 0.80 inches A = 1.10 **DCV =** *(0.75 x 1.0 +0.15) x 0.80 inches x 1.10 ac x 43560 sf/ac x 1/12 ft/in* **= 2,875 cu-ft**
$Q_{80\%}$	$Q_{80\%}$= C x I x A Where: $Q_{80\%}$ = flow rate to achieve 80% capture, cfs C = runoff coefficient = (0.75 x imp + 0.15) I = Rainfall Intensity (in/hr) A = tributary area (acres) I = 0.26 (a conservative Tc of 5 min was used) A = 1.12 **$Q_{80\%}$ =** *(0.75 x 1.0 +0.15) x 0.26 inches/hr x 1.10 ac* **= 0.257 cfs** *Refer to Attachment D for detailed calculations (Worksheet 9)*

Q_{DESIGN}	$Q_{DESIGN} = Q_{80\%}$ x 150% Q_{DESIGN} =0.257 cfs x 1.5 = 0.386 cfs
MWS Size/Model	MWS-L-8-16
Treatment Capacity	0.462 cfs

Since full/partial infiltration and harvest and reuse are considered infeasible in DMA 5, biotreatment BMPs (third priority structural LID BMPs) will be utilized on-site for water quality treatment. The project will implement a series of Modular Wetland System units for water quality treatment to treat all pollutants of concern to a medium to high level of effectiveness. The systems will include the Modular Wetlands Systems developed by Bio Clean Environmental Services, Inc. There are several advantages of the Modular Wetland System over traditional bioretention planters including the following reasons:

- Modular Wetlands are the only proprietary biotreatment device approved through the Washington State University TAPE (Technology Assessment Protocol – Ecology) program for basic storm water treatment and enhanced treatment including sediment, nutrients and heavy metals (all proposed pollutants of concern for the Upper Newport Bay). TAPE approval is based on a series of independent field studies using strict sampling criteria to validate vendor's claims. TAPE approval is considered one of the most stringent and most reliable in the country.
- Modular Wetlands have a pre-treatment chamber that is specifically designed to capture fine sediments and particulates through a series of BioMediaGREEN sponges which prohibit the fines and particulates from entering the bioretention chamber and accelerating potential clogging of the bioretention soil.
- Modular Wetland Systems are specifically designed for higher flow through treatment rates which reduce the potential for nutrient and copper leaching under more stagnant conditions (a common occurrence with planters that are left unmaintained).

Modular Wetlands by Modular Wetlands Systems, Inc. are proprietary biotreatment systems that utilize multi-stage treatment processes including screening media filtration, settling, and biofiltration. The pre-treatment chamber contains the first three stages of treatment, and includes a catch basin inlet filter to capture trash, debris, gross solids and sediments, a settling chamber for separating out larger solids, and a media filter cartridge for capturing fine TSS, metals, nutrients, and bacteria. Runoff then flows through the wetland chamber where treatment is achieved through a variety of physical, chemical, and biological processes. As storm water passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded and sequestered by the soil and plants, functioning similar to bioretention systems. The discharge chamber at the end of the unit collects treated flows and discharges back into the storm drain system.

This system was selected based on its ability to treat the project's pollutants of concerns to a medium or high effectiveness, in accordance with the Model WQMP and TGD requirements. The table below summarizes the overall treatment effectiveness for Modular Wetlands, derived from the Technical

Guidance Document and testing data provided by the manufacturer. Additional details for the Modular Wetland System are included in Attachment C of this WQMP.

POLLUTANTS OF CONCERN AND PERFORMANCE RATINGS		
Pollutant of Concern [1]	**Treatment Effectiveness**	
	Bioretention System [2]	**Modular Wetlands Proprietary Bioretention Units** [3]
Oil & Grease	High	High
Trash & Debris	High	High
Oxygen Demanding Substances	N/A	N/A
Toxic Organic Compounds	Medium	N/A[4]
Primary Pollutant of Concern (303d listed impairments & TMDLs)		
Suspended Solids/Sediments	High	High
Nutrients	Low	Medium-High
Metals	High	High
Pathogens/Bacteria	Medium	Medium-High
Pesticides	N/A	N/A

Notes:
17 See Section II.2.
18 Per Table 4.2 of the Model WQMP's companion Technical Guidance Document dated December 20, 2013.
19 Based on Washington State University Technology Assessment Protocol – Ecology (TAPE) third-party independent field tests for a high-flow biotreatment system with raised under drain (Modular Wetland System-Linear). Refer to manufacturer documentation (attached) for specific removal efficiencies and source references.
20 Field and Lab Testing demonstrates 75-83% removal rates of Chemical Oxygen Demand (COD), a measure of the amount of organic pollutants commonly found in surface water. COD removals of this range would fall within the Medium-High effectiveness category.

The MWS unit for DMA 5 has been sized with Worksheet 9 of the TGD for treatment of 1.5 times the 80% capture flowrate not retained onsite by LID BMPs, per guidelines from the 2017 TGD. Refer to Worksheet 9 in Attachment D for further calculation details.

5.1 LID BMPS IN DMA 6

5.6.1 Hydrologic Source Controls for DMA 6

Hydrologic Source Controls (HSC) are not proposed for DMA 6. The DCV for DMA 6 is addressed through a structural LID BMP (BIO-7: Proprietary Biotreatment).

5.6.2 Structural LID BMP for DMA 6

STRUCTURAL LID BMP FOR DMA 6	
Infiltration Feasibility	*Not feasible. See Section 3.1.2*
Harvest and Use Feasibility	*Not feasible. See Section 3.2.3*
Selected BMP	BIO-7: Proprietary Biotreatment
Selected BMP Sizing Method	Flow-Based Compact Biofiltration
DCV	DCV = C x d x A x 43560 sf/ac x 1/12 ft/in Where: DCV = design storm capture volume, cu-ft C = runoff coefficient = (0.75 x imp + 0.15) Imp = impervious fraction of drainage area (ranges from 0 to 1) d = storm depth (inches) A = tributary area (acres) Imp = 0.85 d = 0.80 inches A = 0.74 DCV = *(0.75 x 0.85 +0.15) x 0.80 inches x 0.74 ac x 43560 sf/ac x 1/12 ft/in* = 1,693 cu-ft
$Q_{80\%}$	$Q_{80\%}$= C x I x A Where: $Q_{80\%}$ = flow rate to achieve 80% capture, cfs C = runoff coefficient = (0.75 x imp + 0.15) I = Rainfall Intensity (in/hr) A = tributary area (acres) I = 0.26 (a conservative Tc of 5 min was used) A = 0.74

	$Q_{80\%}$ = *(0.75 x 0.85 +0.15) x 0.26 inches/hr x 0.74 ac* = 0.152 cfs *Refer to Attachment D for detailed calculations (Worksheet 9)*
Q_{DESIGN}	Q_{DESIGN}= $Q_{80\%}$ x 150% Q_{DESIGN} =0.152 cfs x 1.5 = 0.227 cfs
MWS Size/Model	MWS-L-8-8
Treatment Capacity	0.231 cfs

Since full/partial infiltration and harvest and reuse are considered infeasible in DMA 6, biotreatment BMPs (third priority structural LID BMPs) will be utilized on-site for water quality treatment. The project will implement a series of Modular Wetland System units for water quality treatment to treat all pollutants of concern to a medium to high level of effectiveness. The systems will include the Modular Wetlands Systems developed by Bio Clean Environmental Services, Inc. There are several advantages of the Modular Wetland System over traditional bioretention planters including the following reasons:

- Modular Wetlands are the only proprietary biotreatment device approved through the Washington State University TAPE (Technology Assessment Protocol – Ecology) program for basic storm water treatment and enhanced treatment including sediment, nutrients and heavy metals (all proposed pollutants of concern for the Upper Newport Bay). TAPE approval is based on a series of independent field studies using strict sampling criteria to validate vendor's claims. TAPE approval is considered one of the most stringent and most reliable in the country.
- Modular Wetlands have a pre-treatment chamber that is specifically designed to capture fine sediments and particulates through a series of BioMediaGREEN sponges which prohibit the fines and particulates from entering the bioretention chamber and accelerating potential clogging of the bioretention soil.
- Modular Wetland Systems are specifically designed for higher flow through treatment rates which reduce the potential for nutrient and copper leaching under more stagnant conditions (a common occurrence with planters that are left unmaintained).

Modular Wetlands by Modular Wetlands Systems, Inc. are proprietary biotreatment systems that utilize multi-stage treatment processes including screening media filtration, settling, and biofiltration. The pre-treatment chamber contains the first three stages of treatment, and includes a catch basin inlet filter to capture trash, debris, gross solids and sediments, a settling chamber for separating out larger solids, and a media filter cartridge for capturing fine TSS, metals, nutrients, and bacteria. Runoff then flows through the wetland chamber where treatment is achieved through a variety of physical, chemical, and biological processes. As storm water passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded and sequestered by the soil and plants, functioning similar to bioretention

systems. The discharge chamber at the end of the unit collects treated flows and discharges back into the storm drain system.

This system was selected based on its ability to treat the project's pollutants of concerns to a medium or high effectiveness, in accordance with the Model WQMP and TGD requirements. The table below summarizes the overall treatment effectiveness for Modular Wetlands, derived from the Technical Guidance Document and testing data provided by the manufacturer. Additional details for the Modular Wetland System are included in Attachment C of this WQMP.

POLLUTANTS OF CONCERN AND PERFORMANCE RATINGS		
Pollutant of Concern [1]	**Treatment Effectiveness**	
	Bioretention System [2]	**Modular Wetlands Proprietary Bioretention Units** [3]
Oil & Grease	High	High
Trash & Debris	High	High
Oxygen Demanding Substances	N/A	N/A
Toxic Organic Compounds	Medium	N/A[4]
Primary Pollutant of Concern (303d listed impairments & TMDLs)		
Suspended Solids/Sediments	High	High
Nutrients	Low	Medium-High
Metals	High	High
Pathogens/Bacteria	Medium	Medium-High
Pesticides	N/A	N/A

Notes:
21 See Section II.2.
22 Per Table 4.2 of the Model WQMP's companion Technical Guidance Document dated December 20, 2013.
23 Based on Washington State University Technology Assessment Protocol – Ecology (TAPE) third-party independent field tests for a high-flow biotreatment system with raised under drain (Modular Wetland System-Linear). Refer to manufacturer documentation (attached) for specific removal efficiencies and source references.
24 Field and Lab Testing demonstrates 75-83% removal rates of Chemical Oxygen Demand (COD), a measure of the amount of organic pollutants commonly found in surface water. COD removals of this range would fall within the Medium-High effectiveness category.

The MWS unit for DMA 6 has been sized with Worksheet 9 of the TGD for treatment of 1.5 times the 80% capture flowrate not retained onsite by LID BMPs, per guidelines from the 2017 TGD. Refer to Worksheet 9 in Attachment D for further calculation details.

5.7 LID BMPS IN DMA 7

5.7.1 Hydrologic Source Controls for DMA 7

Hydrologic Source Controls (HSC) are not proposed for DMA 7. The DCV for DMA 7 is addressed through a structural LID BMP (BIO-7: Proprietary Biotreatment).

5.7.2 Structural LID BMP for DMA 7

STRUCTURAL LID BMP FOR DMA 7	
Infiltration Feasibility	*Not feasible. See Section 3.1.2*
Harvest and Use Feasibility	*Not feasible. See Section 3.2.3*
Selected BMP	BIO-7: Proprietary Biotreatment
Selected BMP Sizing Method	Flow-Based Compact Biofiltration
DCV	DCV = C x d x A x 43560 sf/ac x 1/12 ft/in Where: DCV = design storm capture volume, cu-ft C = runoff coefficient = (0.75 x imp + 0.15) Imp = impervious fraction of drainage area (ranges from 0 to 1) d = storm depth (inches) A = tributary area (acres) Imp = 0.85 d = 0.80 inches A = 0.97 DCV = *(0.75 x 0.85 +0.15) x 0.80 inches x 0.97 ac x 43560 sf/ac x 1/12 ft/in* = 2,220 cu-ft
$Q_{80\%}$	$Q_{80\%}$= C x I x A Where: $Q_{80\%}$ = flow rate to achieve 80% capture, cfs C = runoff coefficient = (0.75 x imp + 0.15) I = Rainfall Intensity (in/hr) A = tributary area (acres) I = 0.26 (a conservative Tc of 5 min was used)

	A = 0.97 $Q_{80\%}$ = *(0.75 x 0.85 +0.15) x 0.26 inches/hr x 0.97 ac* = 0.199 cfs *Refer to Attachment D for detailed calculations (Worksheet 9)*
Q_{DESIGN}	Q_{DESIGN}= $Q_{80\%}$ x 150% Q_{DESIGN} =0.199 cfs x 1.5 = 0.298 cfs
MWS Size/Model	MWS-L-8-12
Treatment Capacity	0.346 cfs

Since full/partial infiltration and harvest and reuse are considered infeasible in DMA 7, biotreatment BMPs (third priority structural LID BMPs) will be utilized on-site for water quality treatment. The project will implement a series of Modular Wetland System units for water quality treatment to treat all pollutants of concern to a medium to high level of effectiveness. The systems will include the Modular Wetlands Systems developed by Bio Clean Environmental Services, Inc. There are several advantages of the Modular Wetland System over traditional bioretention planters including the following reasons:

- Modular Wetlands are the only proprietary biotreatment device approved through the Washington State University TAPE (Technology Assessment Protocol – Ecology) program for basic storm water treatment and enhanced treatment including sediment, nutrients and heavy metals (all proposed pollutants of concern for the Upper Newport Bay). TAPE approval is based on a series of independent field studies using strict sampling criteria to validate vendor's claims. TAPE approval is considered one of the most stringent and most reliable in the country.
- Modular Wetlands have a pre-treatment chamber that is specifically designed to capture fine sediments and particulates through a series of BioMediaGREEN sponges which prohibit the fines and particulates from entering the bioretention chamber and accelerating potential clogging of the bioretention soil.
- Modular Wetland Systems are specifically designed for higher flow through treatment rates which reduce the potential for nutrient and copper leaching under more stagnant conditions (a common occurrence with planters that are left unmaintained).

Modular Wetlands by Modular Wetlands Systems, Inc. are proprietary biotreatment systems that utilize multi-stage treatment processes including screening media filtration, settling, and biofiltration. The pre-treatment chamber contains the first three stages of treatment, and includes a catch basin inlet filter to capture trash, debris, gross solids and sediments, a settling chamber for separating out larger solids, and a media filter cartridge for capturing fine TSS, metals, nutrients, and bacteria. Runoff then flows through the wetland chamber where treatment is achieved through a variety of physical, chemical, and

biological processes. As storm water passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded and sequestered by the soil and plants, functioning similar to bioretention systems. The discharge chamber at the end of the unit collects treated flows and discharges back into the storm drain system.

This system was selected based on its ability to treat the project's pollutants of concerns to a medium or high effectiveness, in accordance with the Model WQMP and TGD requirements. The table below summarizes the overall treatment effectiveness for Modular Wetlands, derived from the Technical Guidance Document and testing data provided by the manufacturer. Additional details for the Modular Wetland System are included in Attachment C of this WQMP.

POLLUTANTS OF CONCERN AND PERFORMANCE RATINGS		
Pollutant of Concern [1]	**Treatment Effectiveness**	
	Bioretention System [2]	**Modular Wetlands Proprietary Bioretention Units** [3]
Oil & Grease	High	High
Trash & Debris	High	High
Oxygen Demanding Substances	N/A	N/A
Toxic Organic Compounds	Medium	N/A[4]
Primary Pollutant of Concern (303d listed impairments & TMDLs)		
Suspended Solids/Sediments	High	High
Nutrients	Low	Medium-High
Metals	High	High
Pathogens/Bacteria	Medium	Medium-High
Pesticides	N/A	N/A

Notes:

25 See Section II.2.

26 Per Table 4.2 of the Model WQMP's companion Technical Guidance Document dated December 20, 2013.

27 Based on Washington State University Technology Assessment Protocol – Ecology (TAPE) third-party independent field tests for a high-flow biotreatment system with raised under drain (Modular Wetland System-Linear). Refer to manufacturer documentation (attached) for specific removal efficiencies and source references.

28 Field and Lab Testing demonstrates 75-83% removal rates of Chemical Oxygen Demand (COD), a measure of the amount of organic pollutants commonly found in surface water. COD removals of this range would fall within the Medium-High effectiveness category.

The MWS unit for DMA 7 has been sized with Worksheet 9 of the TGD for treatment of 1.5 times the 80% capture flowrate not retained onsite by LID BMPs, per guidelines from the 2017 TGD. Refer to Worksheet 9 in Attachment D for further calculation details.

5.8 SUMMARY OF LID BMPS

MODULAR WETLAND SYSTEM UNIT DESIGN SUMMARY						
DMA	Total Drainage Area (ac)	% Imp.	$Q_{80\%}$	Q_{DESIGN}	Size/Model	Total Treatment Capacity
DMA 1	1.16	85%	0.238	0.356	MWS-L-8-16	0.462
DMA 2	0.81	85%	0.166	0.249	MWS-L-8-12	0.346
DMA 3	0.41	95%	0.092	0.138	MWS-L-4-13	0.144
DMA 4	0.33	85%	0.068	0.101	MWS-L-4-8	0.115
DMA 5	1.10	100%	0.257	0.386	MWS-L-8-16	0.462
DMA 6	0.74	85%	0.152	0.227	MWS-L-8-8	0.231
DMA 7	0.97	85%	0.199	0.298	MWS-L-8-12	0.346

SECTION 6 HYDROMODIFICATION BMPS

6.1 POINTS OF COMPLIANCE

Not Applicable. Refer to Section 3.5.

6.2 PRE-DEVELOPMENT (NATURAL) CONDITIONS

Not Applicable. Refer to Section 3.5.

6.3 POST-DEVELOPMENT CONDITIONS AND HYDROMODIFICATION BMPS

Not Applicable. Refer to Section 3.5.

6.4 MEASURES FOR AVOIDANCE OF CRITICAL COARSE SEDIMENT YIELD AREAS

Not Applicable. Refer to Section 3.5.

6.5 HYDROLOGIC MODELING AND HYDROMODIFICATION COMPLIANCE

Not Applicable. Refer to Section 3.5.

SECTION 7 EDUCATIONAL MATERIALS INDEX

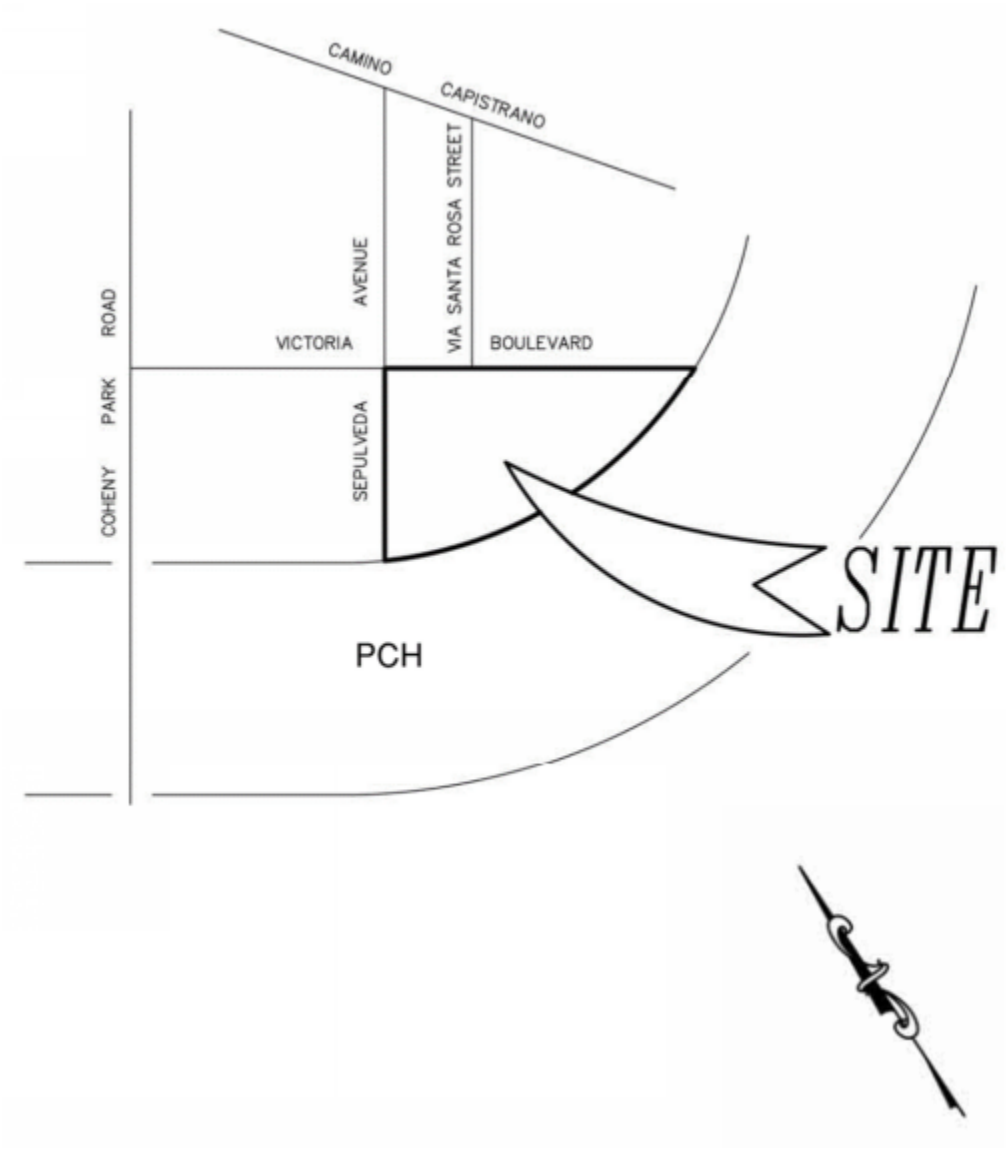
EDUCATION MATERIALS			
Residential Materials (http://www.ocwatersheds.com)	**Check if Applicable**	**Business Materials (http://www.ocwatersheds.com)**	**Check if Applicable**
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☐	Tips for Using Concrete and Mortar	☐
Tips for the Home Mechanic	☐	Tips for the Food Service Industry	☐
Household Tips	☒	Proper Maintenance Practices for Your Business	☐
Homeowners Guide for Sustainable Water Use	☒	Compliance BMPs for Mobile Businesses	☐
Proper Disposal of Household Hazardous Waste	☒	**Other Materials**	**Check if Attached**
Recycle at Your Local Used Oil Collection Center (North County)	☐	DF-1 Drainage System Operation & Maintenance	☒
Recycle at Your Local Used Oil Collection Center (Central County)	☐	R-1 Automobile Repair & Maintenance	☐
Recycle at Your Local Used Oil Collection Center (South County)	☒	R-2 Automobile Washing	☐
Tips for Maintaining a Septic Tank System	☐	R-3 Automobile Parking	☒
Responsible Pest Control	☒	R-4 Home & Garden Care Activities	☒
Sewer Spill	☐	R-5 Disposal of Pet Waste	☒
Tips for the Home Improvement Projects	☐	R-6 Disposal of Green Waste	☒
Tips for Horse Care	☐	R-7 Household Hazardous Waste	☒
Tips for Landscaping and Gardening	☒	R-8 Water Conservation	☒
Tips for Pet Care	☒	SD-10 Site Design & Landscape Planning	☒
Tips for Pool Maintenance	☒	SD-11 Roof Runoff Controls	☐
Tips for Residential Pool, Landscape and Hardscape Drains	☒	SD-12 Efficient Irrigation	☒
Tips for Projects Using Paint	☐	SD-13 Storm Drain Signage	☒
Other:	☐	SD-31 Maintenance Bays & Docks	☐

ATTACHMENTS

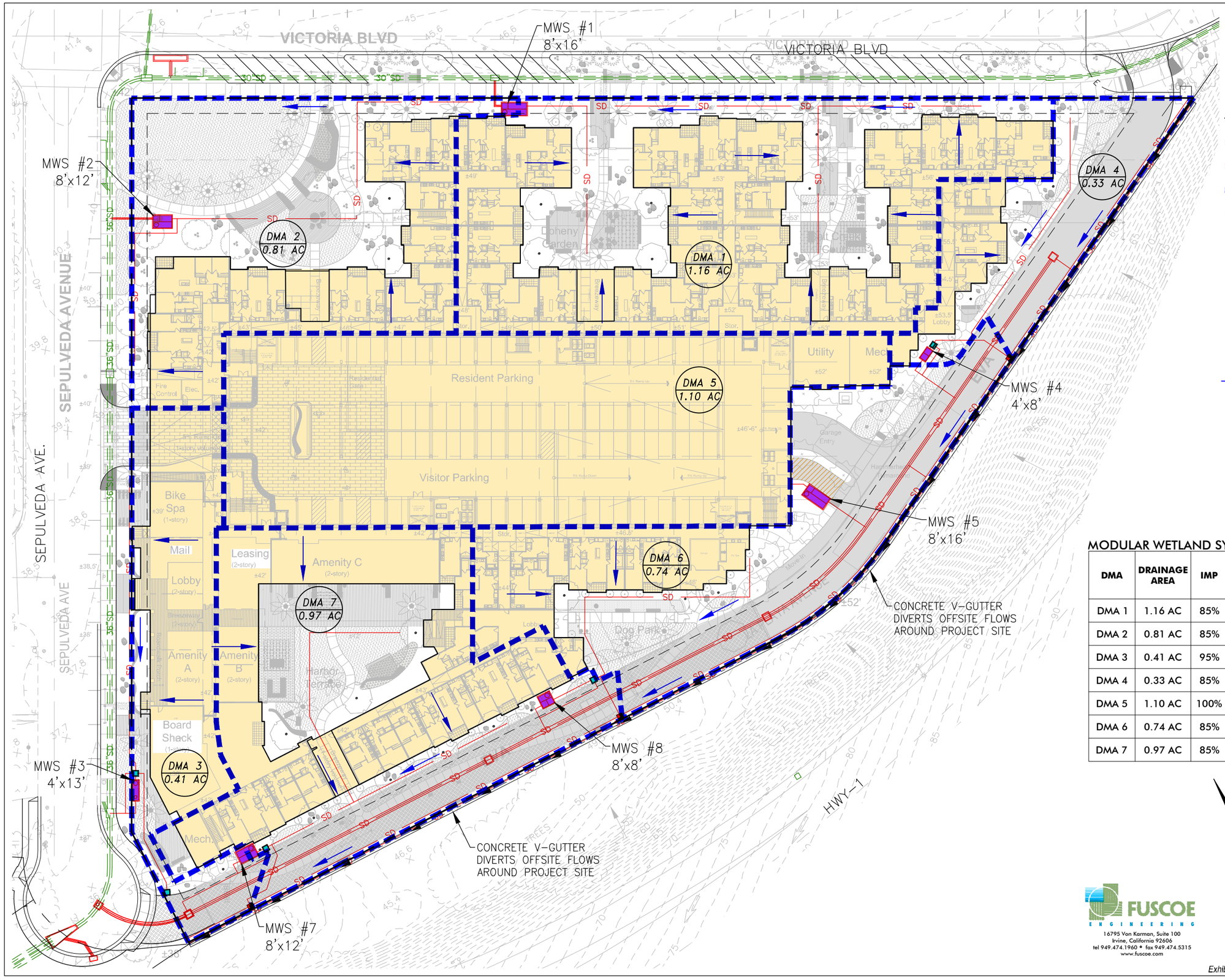
ATTACHMENT 1 PHOTOS AND EXHIBITS

- Vicinity Map
- WQMP Exhibit
- MWS Cross Section Details

VICINITY MAP



Not to Scale



LEGEND

- PROPERTY LINE
- EXISTING STORM DRAIN TO REMAIN
- PROPOSED STORM DRAIN
- BMP DRAINAGE AREA BOUNDARY
- PROPOSED LANDSCAPE
- PROPOSED BUILDING
- STREET SWEEPING PRIVATE STREETS & DRIVE AISLES
- CATCH BASIN STENCILING & MAINTENANCE
- LOW FLOW DIVERSION STRUCTURE
- MODULAR WETLAND SYSTEM UNIT
- TRASH STAGING AREA / LOADING ZONE
- DIRECTION OF FLOW
- DRAINAGE MANAGEMENT AREA AND ACREAGE (DMA_1 X.XX_AC)

MODULAR WETLAND SYSTEM DESIGN SUMMARY

DMA	DRAINAGE AREA	IMP	Q FLOW RATE 80% CAPTURE	Q DESIGN (80% X 1.5)	SIZE / MODEL	TOTAL TREATMENT CAPACITY
DMA 1	1.16 AC	85%	0.238 CFS	0.356 CFS	MWS-L-8-16	0.462 CFS
DMA 2	0.81 AC	85%	0.166 CFS	0.249 CFS	MWS-L-8-12	0.346 CFS
DMA 3	0.41 AC	95%	0.092 CFS	0.138 CFS	MWS-L-4-13	0.144 CFS
DMA 4	0.33 AC	85%	0.068 CFS	0.101 CFS	MWS-L-4-8	0.115 CFS
DMA 5	1.10 AC	100%	0.257 CFS	0.386 CFS	MWS-L-8-16	0.462 CFS
DMA 6	0.74 AC	85%	0.150 CFS	0.227 CFS	MWS-L-8-8	0.231 CFS
DMA 7	0.97 AC	85%	0.199 CFS	0.298 CFS	MWS-L-8-12	0.346 CFS

60' 0' 30' 60'

SCALE: 1" = 60'

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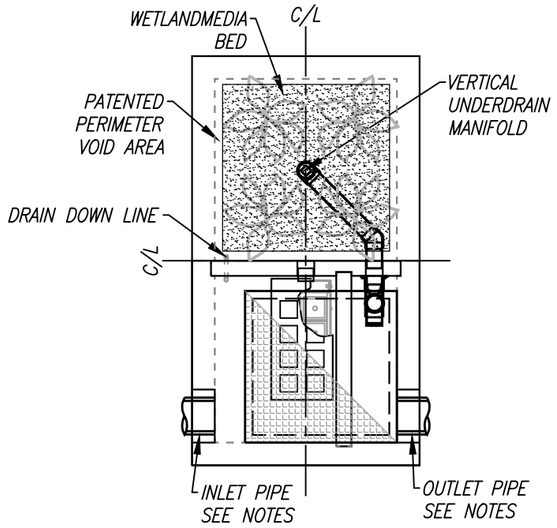
Exhibit Date: 06/30/2023

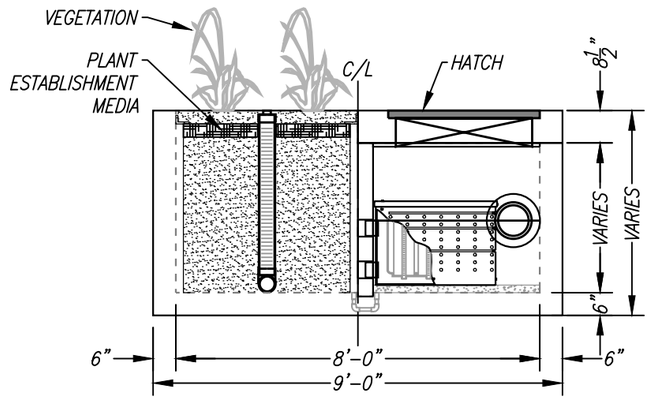
PRELIMINARY WQMP EXHIBIT
VICTORIA APARTMENTS
DANA POINT, CA

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID		MWS #4	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.115	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	36" X 36"	OPEN PLANTER	N/A
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



LEFT END VIEW

INSTALLATION NOTES

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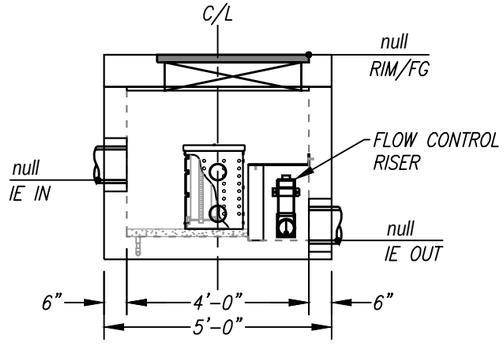
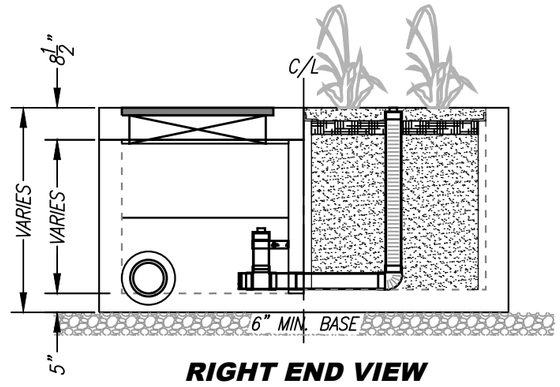


ELEVATION VIEW



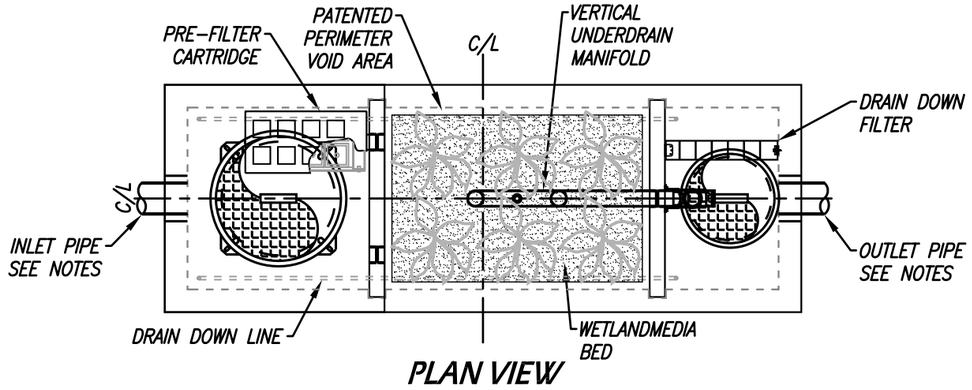
RIGHT END VIEW

TREATMENT FLOW (CFS)	0.115
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

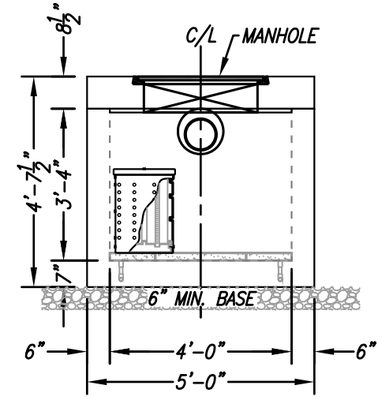
MWS-L-4-8-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

5/23/19 10:LEF

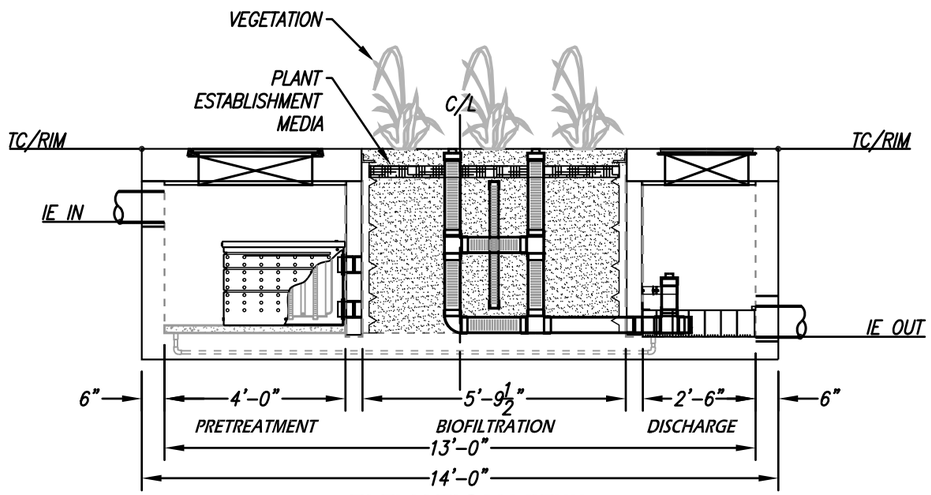
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID		MWS #3	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			3.05
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.71"
MAXIMUM PICK WEIGHT (LBS)			27000
NOTES:			



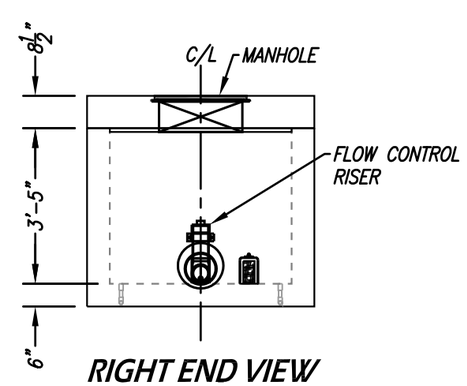
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

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3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON–SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

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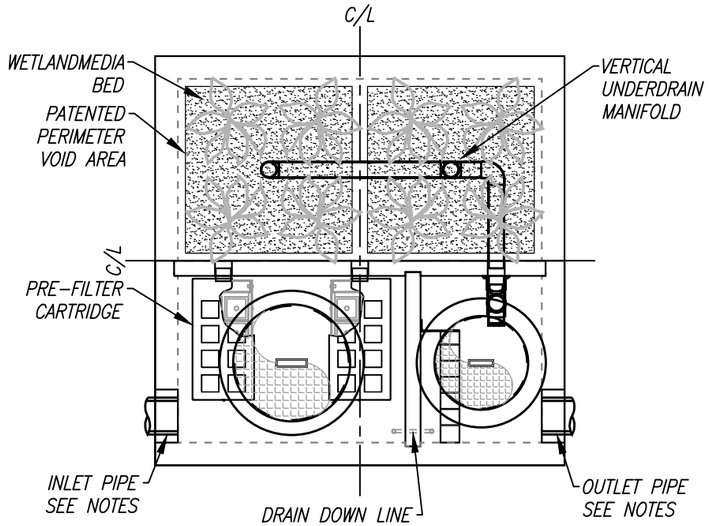
TREATMENT FLOW (CFS)	0.144
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MODULAR WETLANDS
www.ModularWetlands.com | (855) 5MOD-WET

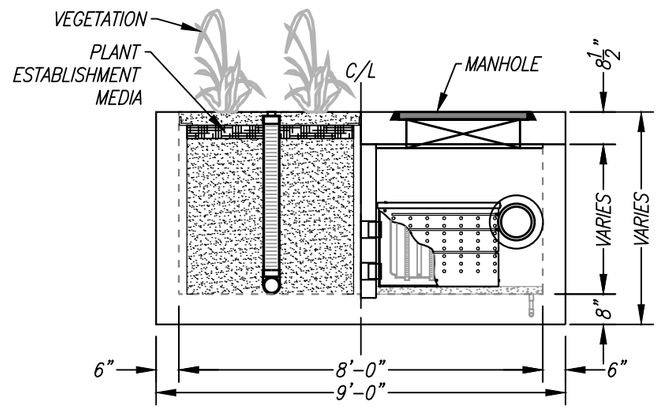
MWS-L-4-13-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID		MWS #6	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.231	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	ø30"	OPEN PLANTER	ø24"
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



LEFT END VIEW

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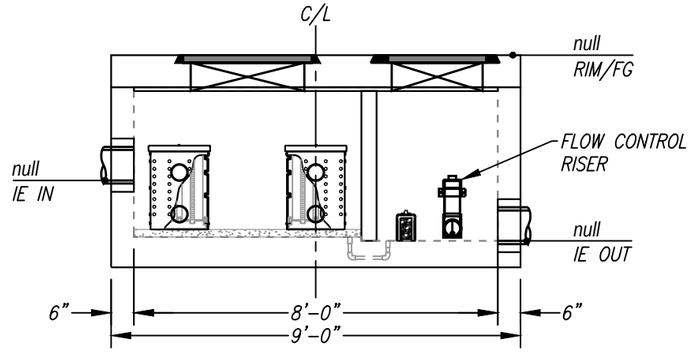
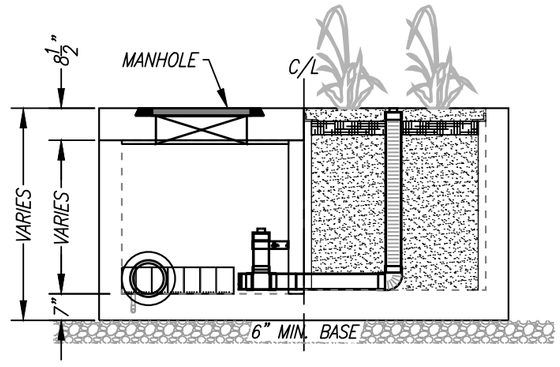


ELEVATION VIEW



RIGHT END VIEW

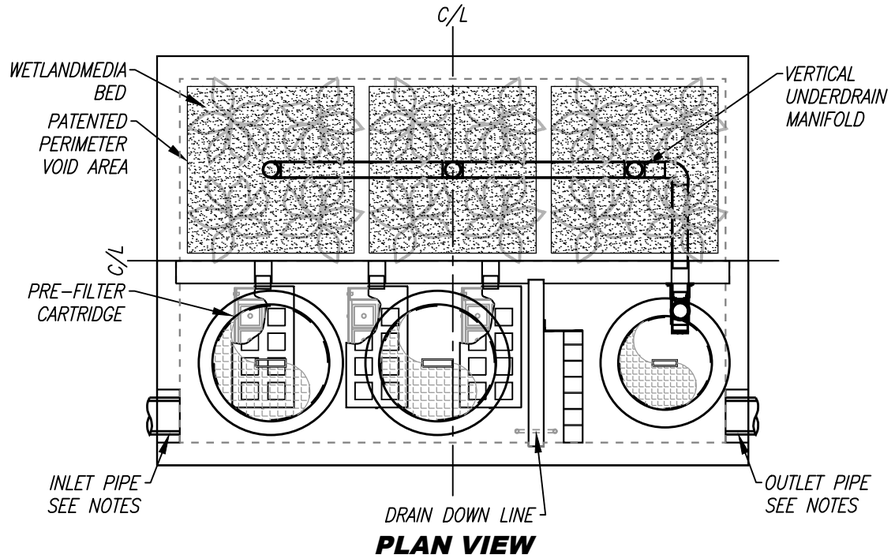
TREATMENT FLOW (CFS)	0.231
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-8-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

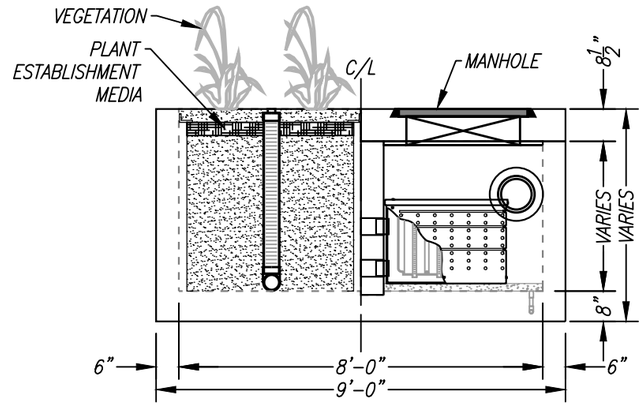
5/23/19 10:LEF

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID		MWS #7 and MWS #2	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.346	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	2EA ø30"	OPEN PLANTER	ø24"
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



LEFT END VIEW

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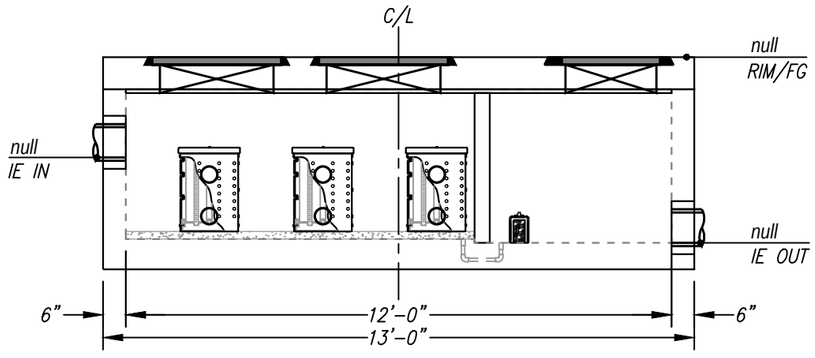
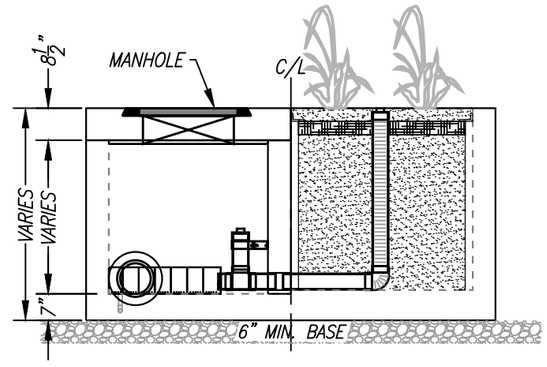


ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.346
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-12-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

5/23/19 10:LEF

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID		MWS #1 and MWS #5	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.462	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	2EA ø30"	OPEN PLANTER	ø24"
NOTES:			

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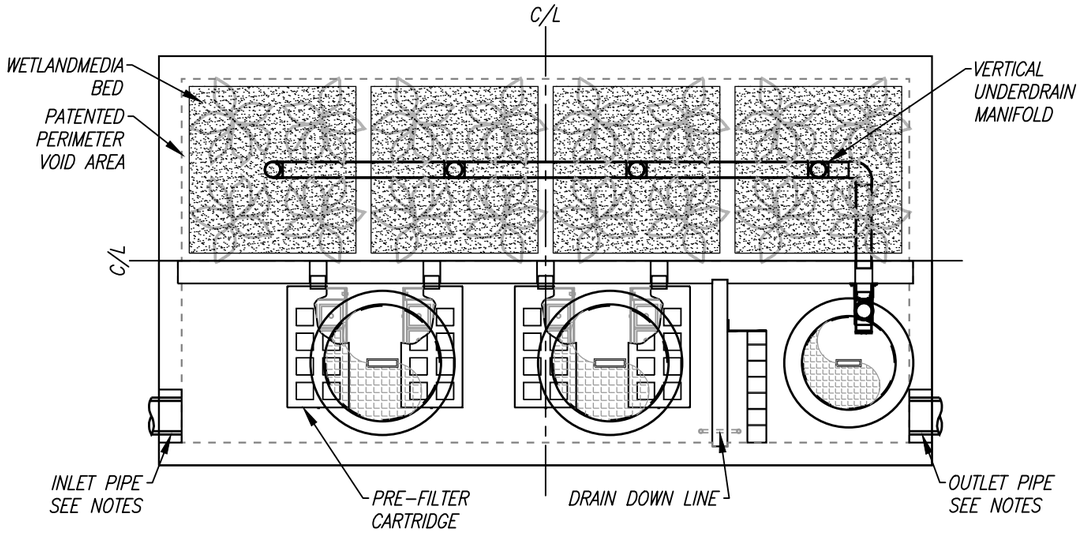
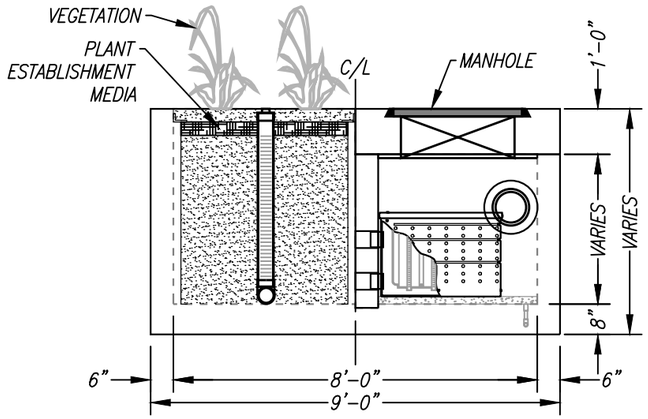


PLAN VIEW



LEFT END VIEW

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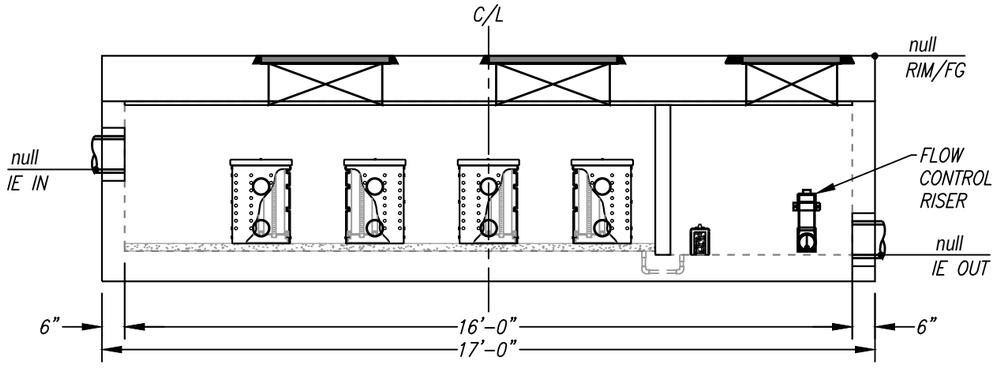
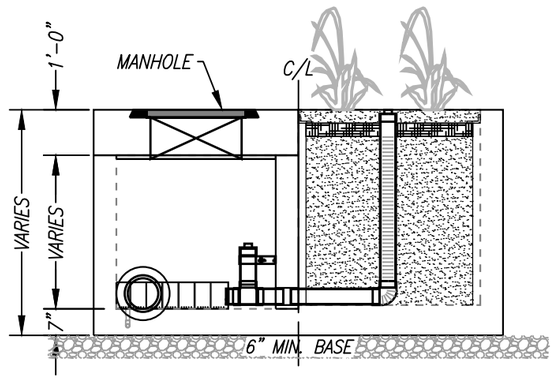


ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.462
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-16-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

5/23/19 10:LEF

ATTACHMENT 2 MAINTENANCE AGREEMENT & FUNDING MECHANISM DOCUMENTATION

The Owner, Toll Brothers Apartment Living, shall assume all BMP maintenance and inspection responsibilities for the proposed project. Should the maintenance responsibility be transferred at any time during the operational life of Victoria Apartments, such as when an HOA or POA is formed for a project, a formal notice of transfer shall be submitted to the City of Dana Point at the time responsibility of the property subject to this WQMP is transferred. The transfer of responsibility shall be incorporated into this O&M Plan.

Long-term-funding for BMP maintenance will be provided by Toll Brothers Apartments through the standard operating budget.

Copies of the forms and additional details will be included in the Final WQMP.

NOTICE OF TRANSFER OF RESPONSIBILITY

WATER QUALITY MANAGEMENT PLAN

Victoria Apartments
APN 668-361-01

Submission of this Notice Of Transfer of Responsibility constitutes notice to the City of Dana Point that responsibility for the Water Quality Management Plan ("WQMP") for the subject property identified below, and implementation of that plan, is being transferred from the Previous Owner (and his/her agent) of the site (or a portion thereof) to the New Owner, as further described below.

I. Previous Owner/ Previous Responsible Party Information

Company/ Individual Name:		Contact Person:	
Street Address:		Title:	
City:	State:	ZIP:	Phone:

II. Information about Site Transferred

Name of Project (if applicable):	
Title of WQMP Applicable to site:	
Street Address of Site (if applicable):	
Planning Area (PA) and/ or Tract Number(s) for Site:	Lot Numbers (if Site is a portion of a tract):
Date WQMP Prepared (and revised if applicable):	

III. New Owner/ New Responsible Party Information

Company/ Individual Name:		Contact Person:	
Street Address:		Title:	
City:	State:	ZIP:	Phone:

IV. Ownership Transfer Information

General Description of Site Transferred to New Owner:	General Description of Portion of Project/ Parcel Subject to WQMP Retained by Owner (if any):

Lot/ Tract Numbers of Site Transferred to New Owner:
Remaining Lot/ Tract Numbers Subject to WQMP Still Held by Owner (if any):
Date of Ownership Transfer:

Note: When the Previous Owner is transferring a Site that is a portion of a larger project/ parcel addressed by the WQMP, as opposed to the entire project/parcel addressed by the WQMP, the General Description of the Site transferred and the remainder of the project/ parcel no transferred shall be set forth as maps attached to this notice. These maps shall show those portions of a project/ parcel addressed by the WQMP that are transferred to the New Owner (the Transferred Site), those portions retained by the Previous Owner, and those portions previously transferred by Previous Owner. Those portions retained by Previous Owner shall be labeled as "Previously Transferred".

V. Purpose of Notice of Transfer

The purposes of this Notice of Transfer of Responsibility are: 1) to track transfer of responsibility for implementation and amendment of the WQMP when property to which the WQMP is transferred from the Previous Owner to the New Owner, and 2) to facilitate notification to a transferee of property subject to a WQMP that such New Order is now the Responsible Party of record for the WQMP for those portions of the site that it owns.

VI. Certifications

A. Previous Owner

I certify under penalty of law that I am no longer the owner of the Transferred Site as described in Section II above. I have provided the New Owner with a copy of the WQMP applicable to the Transferred Site that the New Owner is acquiring from the Previous Owner.

Printed Name of Previous Owner Representative:	Title:
Signature of Previous Owner Representative:	Date:

B. New Owner

I certify under penalty of law that I am the owner of the Transferred Site, as described in Section II above, that I have been provided a copy of the WQMP, and that I have informed myself and understand the New Owner's responsibilities related to the WQMP, its implementation, and Best Management Practices associated with it. I understand that by signing this notice, the New Owner is accepting all ongoing responsibilities for implementation and amendment of the WQMP for the Transferred Site, which the New Owner has acquired from the Previous Owner.

Printed Name of New Owner Representative:	Title:
Signature:	Date:

FORM FOR WQMP CONSTRUCTION CERTIFICATION

CIVIL ENGINEER'S LETTERHEAD

City of Dana Point
Department of Public Works/Engineering
33282 Golden Lantern
Dana Point, CA 92629

Attention: Lisa Zawaski, Senior Water Quality Engineer

Subject: **WQMP Construction Certification**

Reference Project: Grading Permit No. _____

Address: _____

Project Name: _____

I hereby certify that the above referenced project has been field inspected to confirm that the structural best management practices (BMPs) have been installed per the project's approved Water Quality Management Plan (WQMP) and associated grading plans and in accordance with my responsibilities as a Civil Engineer in the State of California.

By way of this certification, I hereby declare that the BMPs are operational and functioning properly for intended use and that any debris that may have been accumulated during construction has been removed.

_____
Signature

(R.C.E. #_____)

Engineer's Wet Stamp Here

ATTACHMENT 3 TRAINING LOG FORM

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

For newsletter or mailer educational activities, please include the following information:

- Date of mailing:
- Number distributed:
- Method of distribution:
- Topics addressed:

If a newsletter article was distributed, please include a copy of it.

ATTACHMENT 4 INSPECTION AND MAINTENANCE LOG FORM

TRAINING / EDUCATIONAL LOG

Date of Training/Educational Activity: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

BMP Name or Type (As Shown in O&M Plan)	Brief Description of Operation, Maintenance or Inspection Activity Performed	Summary of Notable Observations or Outcomes from Activity

[add additional pages, photographs, drawings, notes as needed]

CITY OF DANA POINT
WATER QUALITY MANAGEMENT PLAN (WQMP) VERIFICATION SURVEY

Project Name/Site Address: _____

Responsible Party: _____

Contact Phone: _____ Contact Email: _____

1. Have your contractors (landscape, maintenance, etc.) been educated regarding the applicable requirements to prevent pollution as outlined in the WQMP?

   ☐ Yes ☐ No Name of Landscape/Maintenance Contractor:

   _____

   Method of education (contract language, Copy of O&M, educational brochures, etc.):

   _____

2. Have the storm drains and inlets been inspected and maintained, at a minimum, annually prior to Oct 1?

   ☐ Yes ☐ No Date of Last Inspection/Maintenance:

   _____

   Maintenance conducted by:

   _____

3. Have you observed any runoff from the irrigation system?

   ☐ Yes ☐ No If yes, how was the problem resolved?: _____

   _____

4. What type of Integrated Pest Management (IPM) practices are used on site?

   _____

5. Are native and/or drought tolerant plants established and considered for any new landscaping?

   ☐ Yes ☐ No

6. Have the storm drain stencils been inspected annually for legibility prior to Oct. 1?

   ☐ Yes ☐ No Total number of stencils on site: _____

   How many inlets required restenciling / date of restenciling? _____ /_____

7. Have education materials been distributed to the residents/tenants/contractors within the past year?

   ☐ Yes ☐ No Topic / Date of Distribution: _____ / _____

   Method of Distribution: newsletter, billing insert, etc.: _____

8. Is street sweeping conducted weekly?

   ☐ Yes ☐ No Contractor: _____

9. Are trash areas in common area inspected daily?

   ☐ Yes ☐ No

10. Have any vector concerns been observed (standing water, mosquito larvae, etc.). if yes, please contact Orange County Vector Control District at www.ocvcd.org.

    ☐ Yes ☐ No

11. Have the Modular Wetland System units (7) been inspected and maintained per Manufacturer instructions? (attach invoices and inspection/maintenance forms).

    ☐ Yes ☐ No

12. Have there been any issues with operation and maintenance of the Modular Wetland System units (7)?

    _____

I certify that the above information is correct and that the BMPs for this project have been implemented and operated and maintained in accordance with the Operation and Maintenance (O&M) Plan on site and on file at the City.

_____
Print Name of Responsible Party

_____ _____
Signature (required) Date

This form must be completed and submitted to the City by June 30 each year.

City of Dana Point • 33282 Golden Lantern • Dana Point • 92629
Attn: Water Quality Engineer

Email: lzawaski@danapoint.org
Fax: 949-234-2826

ATTACHMENT 5 INSPECTION AND O&M CHECKLIST (OPTIONAL)

Guidance: Based on the BMPs present at the site, this checklist is intended to summarize the activities necessary at each frequency. Include more details if desired.

Weekly Activities	Check Box
Selected source control/housekeeping activities (See Section 3.1)	
Monthly Activities	
Selected source control/housekeeping activities (See Section 3.1)	
Quarterly Activities (before wet season, after wet season, plus twice after rain > 0.5 inches)	
Inspections of selected source control BMPs (See Section 3.1)	
Inspections and as-needed minor maintenance of all structural treatment and hydromodification BMPs (See Section 3.3)	
Twice Yearly Activities (during dry weather)	
Dry weather flow inspections (non-structural source control) (See Section 3.1)	
Inspection and as-needed maintenance of other selected source control BMPs (See Section 3.1)	
Annual Activities	
Self-certification (See Section 2.6)	
Various source control BMP and housekeeping activities (See Section 3.1)	
Inspection and maintenance of HSCs (See Section 3.2)	
Various planned maintenance activities of treatment and hydromodification BMPs, such as vegetation maintenance, minor sediment maintenance, etc. (See Section 3.3)	

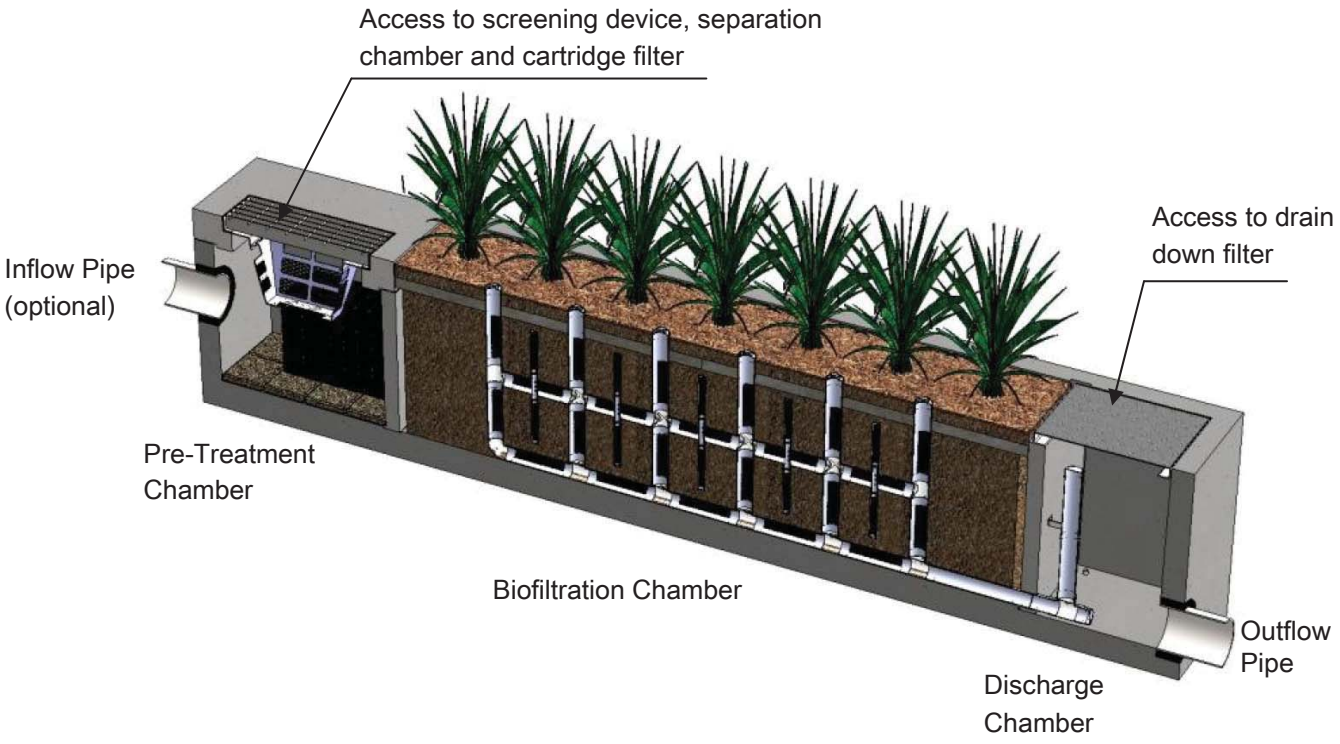
ATTACHMENT 6 VENDOR O&M INFORMATION

Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended 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 require irrigation.

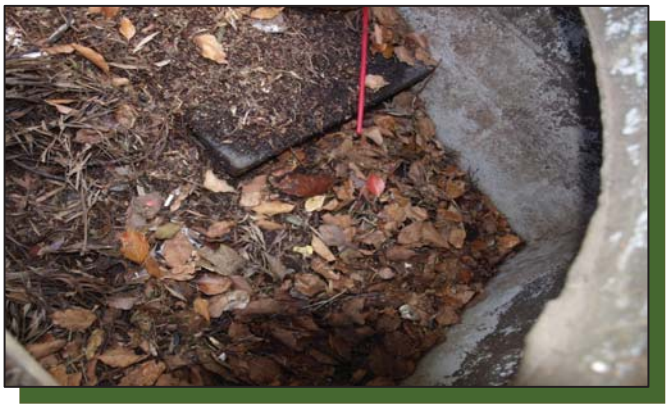
Maintenance Procedure Illustration

Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.

Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.



Cartridge Filters

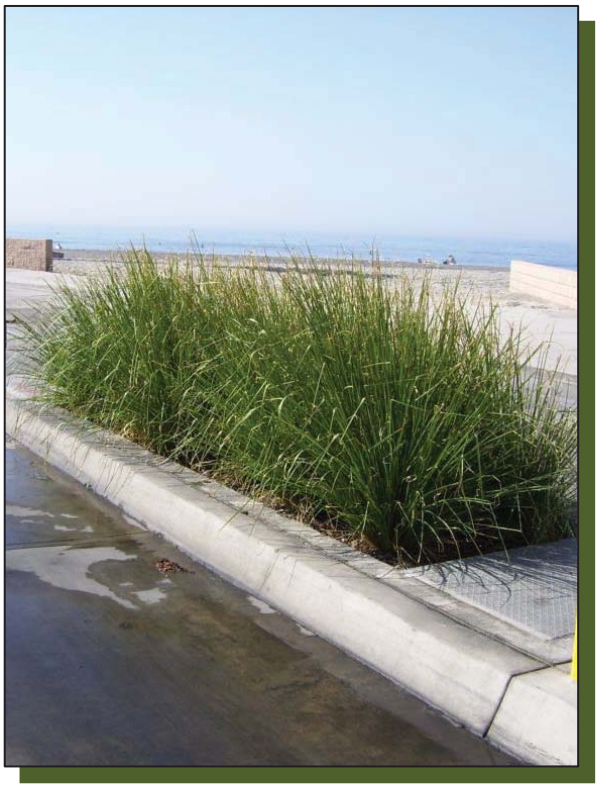
The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.

Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.



Inspection Form

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Inspection Report
Modular Wetlands System

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.

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: _____

2972 San Luis Rey Road, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

Maintenance Report

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

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: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

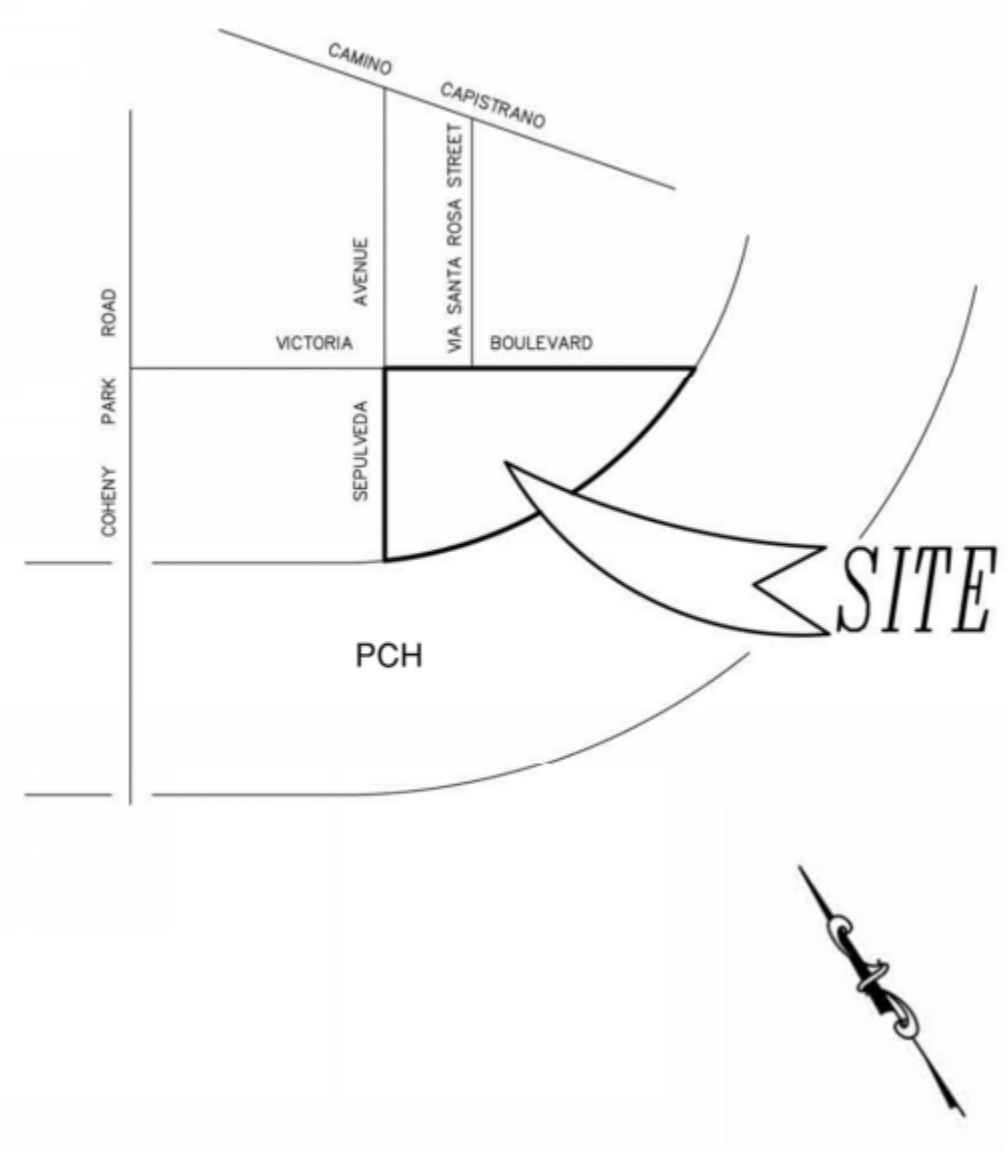
Comments:

2972 San Luis Rey Road, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

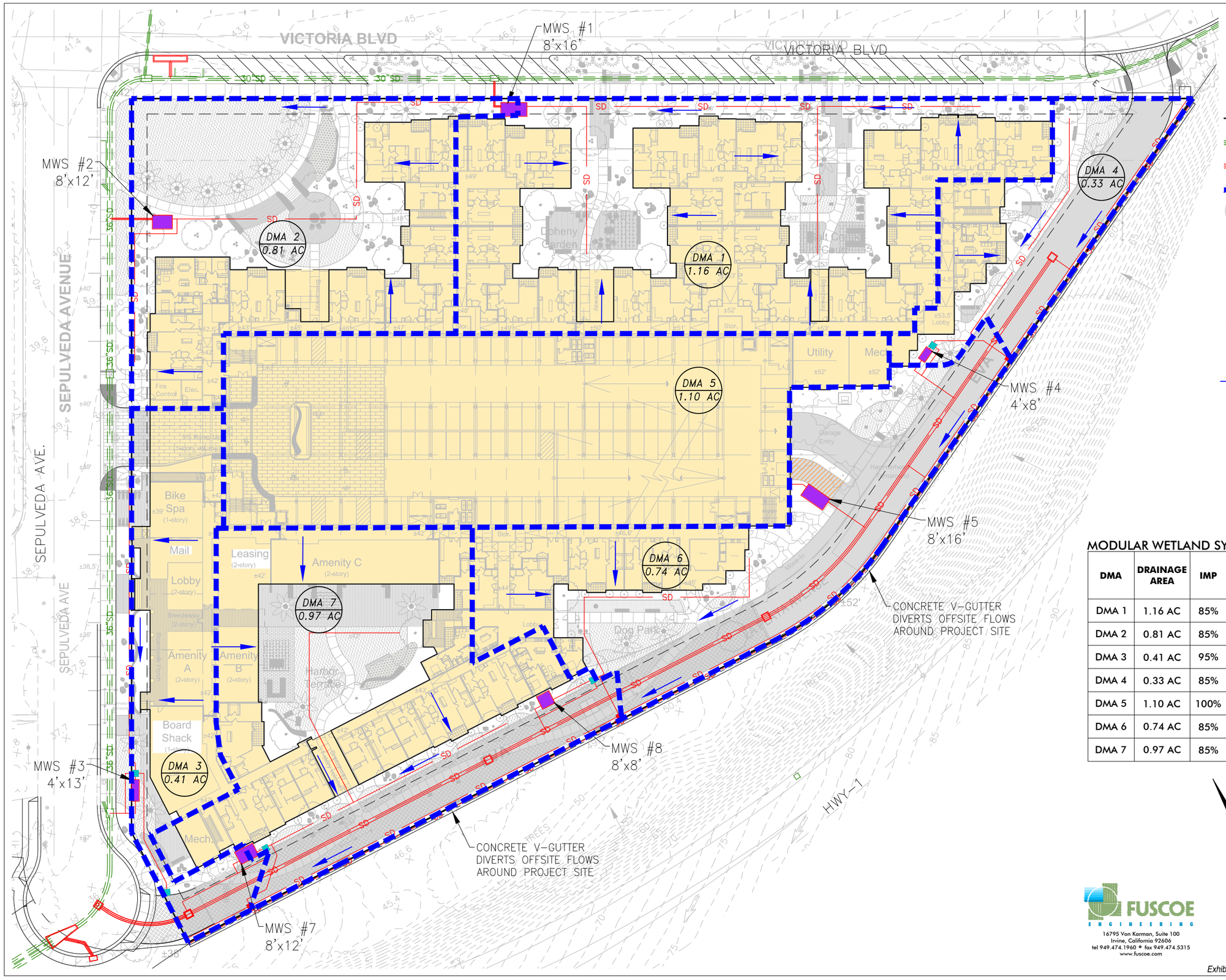
ATTACHMENT C

EXHIBITS

VICINITY MAP



Not to Scale



LEGEND

- PROPERTY LINE
- EXISTING STORM DRAIN TO REMAIN
- PROPOSED STORM DRAIN
- BMP DRAINAGE AREA BOUNDARY
- PROPOSED LANDSCAPE
- PROPOSED BUILDING
- STREET SWEEPING PRIVATE STREETS & DRIVE AISLES
- CATCH BASIN STENCILING & MAINTENANCE
- LOW FLOW DIVERSION STRUCTURE
- MODULAR WETLAND SYSTEM UNIT
- TRASH STAGING AREA / LOADING ZONE
- DIRECTION OF FLOW
- DRAINAGE MANAGEMENT AREA AND ACREAGE (DMA_1 X.XX_AC)

MODULAR WETLAND SYSTEM DESIGN SUMMARY

DMA	DRAINAGE AREA	IMP	Q FLOW RATE 80% CAPTURE	Q DESIGN (80% X 1.5)	SIZE / MODEL	TOTAL TREATMENT CAPACITY
DMA 1	1.16 AC	85%	0.238 CFS	0.356 CFS	MWS-L-8-16	0.462 CFS
DMA 2	0.81 AC	85%	0.166 CFS	0.249 CFS	MWS-L-8-12	0.346 CFS
DMA 3	0.41 AC	95%	0.092 CFS	0.138 CFS	MWS-L-4-13	0.144 CFS
DMA 4	0.33 AC	85%	0.068 CFS	0.101 CFS	MWS-L-4-8	0.115 CFS
DMA 5	1.10 AC	100%	0.257 CFS	0.386 CFS	MWS-L-8-16	0.462 CFS
DMA 6	0.74 AC	85%	0.150 CFS	0.227 CFS	MWS-L-8-8	0.231 CFS
DMA 7	0.97 AC	85%	0.199 CFS	0.298 CFS	MWS-L-8-12	0.346 CFS

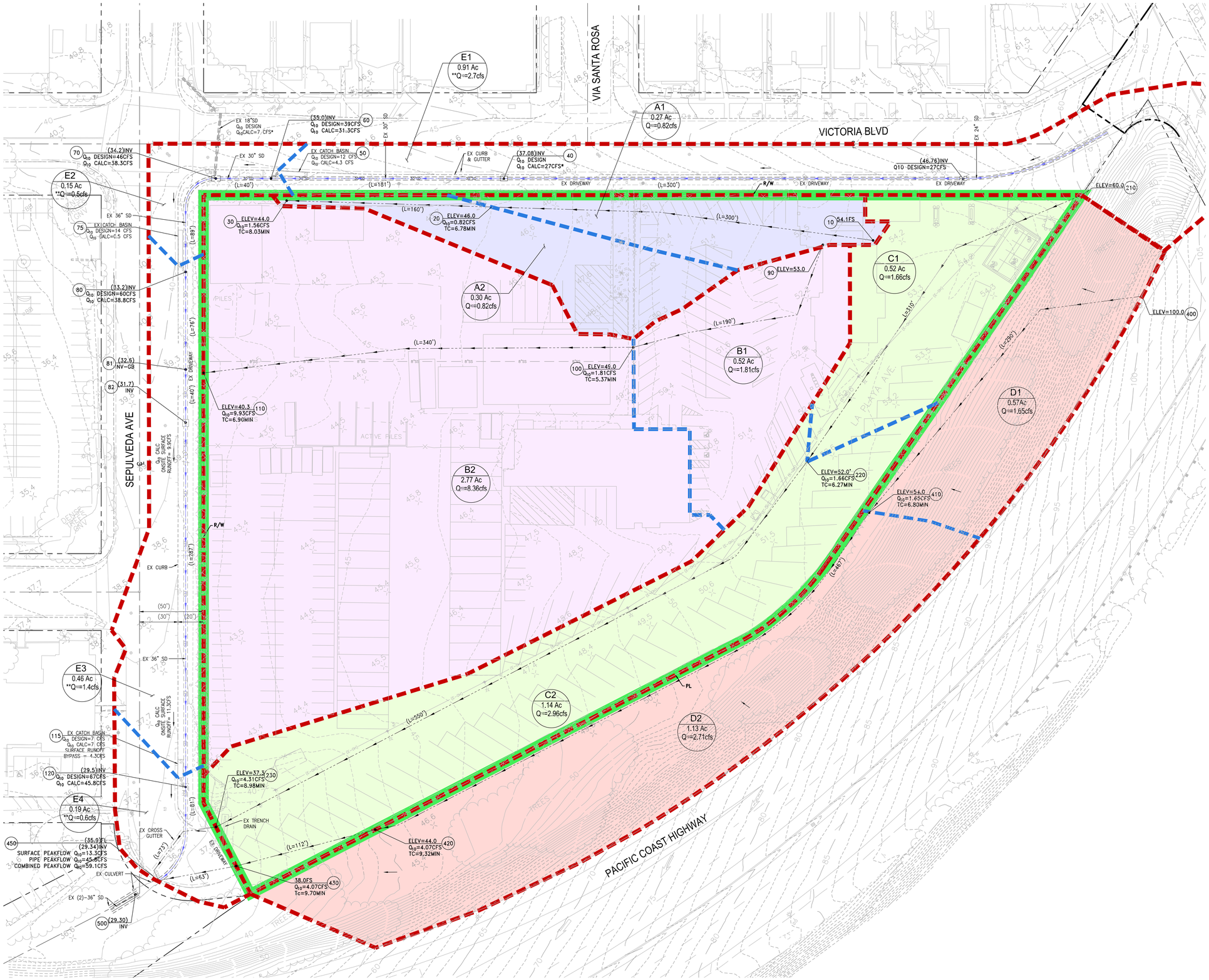
60' 0' 30' 60'

SCALE: 1" = 60'

FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 • fax 949.474.5315
www.fuscoe.com

Exhibit Date: 07/27/2022

PRELIMINARY WQMP EXHIBIT
VICTORIA APARTMENTS
DANA POINT, CA



LEGEND

- PROPERTY LINE
- ONSITE BOUNDARY (5.52 Ac)
- DRAINAGE MAJOR SUB-BOUNDARY
- DRAINAGE MINOR SUB-BOUNDARY
- EXISTING STORM DRAIN
- HYDROLOGIC NODE
- DRAINAGE AREA DESIGNATION (A1)
- AREA (3.2 ac)
- FLOWRATE (Q_{10}=2.2 cfs)
- STREET WHICH AREA DRAINS TOWARD

- SUB-AREA A (0.57 Ac/1.56 cfs @ NODE 30)
- SUB-AREA B (3.29 Ac/9.93 cfs @ NODE 110)
- SUB AREA C (1.66 Ac/4.31 cfs @ NODE 230)
- SUB-AREA D – OFFSITE RUN-ON (1.70 Ac/4.07 cfs @ NODE 430)

HYDROLOGIC PARAMETERS

STUDY AREA: 7.22 Ac = 5.52 Ac (ONSITE) + 1.70 Ac (OFFSITE)

SOIL GROUP: D

ZONE X PER FEMA FIRM MAP NO 06059C0508K

ABBREVIATIONS

AC	ACRE
CFS	CUBIC FEET PER SECOND
℄	CENTERLINE
ELEV	ELEVATION
EX	EXISTING
FG	FINISHED GRADE
FS	FINISHED SURFACE
GB	GRADE BREAK
INV	INVERT
L	LENGTH
MIN	MINUTES
ℙ	PROPERTY LINE
R/W	RIGHT OF WAY
SD	STORM DRAIN
TG	TOP OF GRATE
TYP	TYPICAL

EXISTING STORM DRAIN REFERENCE

CITY OF DANA POINT STORM DRAIN IMPROVEMENT IN VICTORIA BOULEVARD & SEPULVEDA AVENUE APPROVED ON 5/7/1992.

Q_{10} DESIGN IN EXISTING STORM DRAIN USED FROM THIS REFERENCE PLAN.

KEY ASSUMPTIONS

* – ASSUMES FULL CAPTURE OF 10-YEAR STORM DESIGN FROM REFERENCE AS-BUILT.

** – STREET PEAK RUNOFF CALULATED FROM CONSERVATIVE FACTOR OF 3 CFS PER ACRE. NO ROUTING PERFORMED.

N

30' 0' 15' 30'

SCALE: 1" = 30'

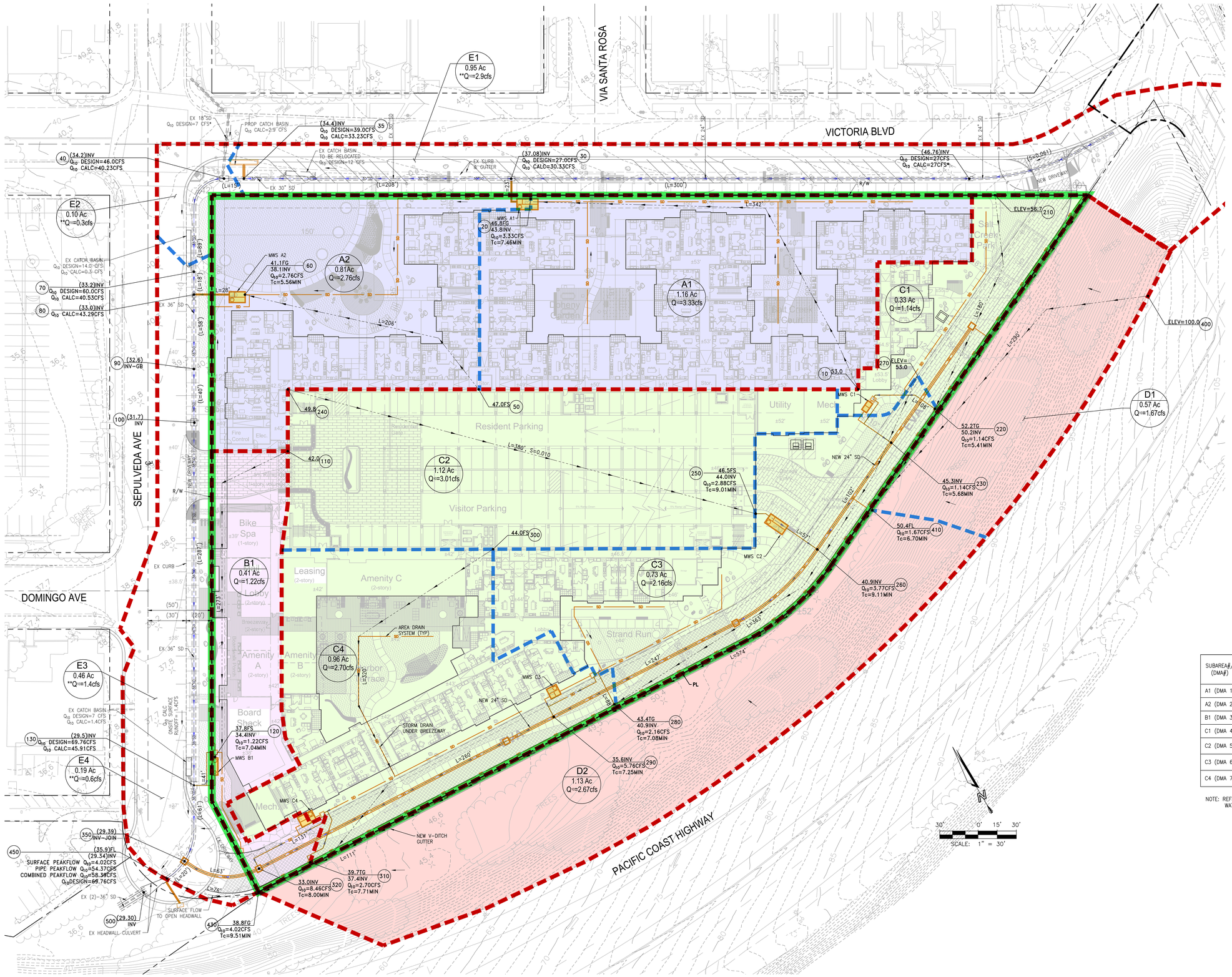
VICTORIA APARTMENTS

26126 VICTORIA BLVD, DANA POINT, CA

EXISTING HYDROLOGY

May 27, 2020

FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 ⁹ fax 949.474.5315
www.fuscoe.com



LEGEND

- PROPERTY LINE/RIGHT OF WAY LINE
- ONSITE BOUNDARY (5.52 Ac)
- MAJOR DRAINAGE SUB-BOUNDARY
- MINOR DRAINAGE SUB-BOUNDARY
- EXISTING STORM DRAIN
- NEW STORM DRAIN
- (10) HYDROLOGIC NODE
- A1 / 3.2 ac / Q_{10}=2.2 cfs — DRAINAGE AREA DESIGNATION, AREA, FLOWRATE
- STORM EVENT FREQUENCY (IN YEARS)
- SURFACE FLOW
- PIPE FLOW
- PROPOSED MODULAR WETLANDS

TRIBUTARY AREAS

- SUB AREA A (1.97 Ac/5.54 cfs @ NODE 80)
- SUB-AREA B (0.41 Ac/1.22 cfs @ NODE 120)
- SUB-AREA C (3.14 Ac/8.46 cfs @ NODE 320)
- SUB-AREA D – OFFSITE RUNOFF (1.70 Ac/4.02 cfs @ NODE 430)

SITE PARAMETERS

STUDY AREA: 7.22 Ac = 5.52 Ac (ONSITE) + 1.70 Ac (OFFSITE)

SOIL GROUP: D

ZONE X PER FEMA FIRM MAP NO 06059C0508K

ABBREVIATIONS

AC	ACRE
CFS	CUBIC FEET PER SECOND
℄	CENTERLINE
DMA	DRAINAGE MANAGEMENT AREA
ELEV	ELEVATION
EX	EXISTING
FG	FINISHED GRADE
FS	FINISHED SURFACE
GB	GRADE BREAK
INV	INVERT
L	LENGTH
MIN	MINUTES
MWS	MODULAR WETLANDS SYSTEM
R	PROPERTY LINE
POC	POINT OF CONNECTION
R/W	RIGHT OF WAY
SD	STORM DRAIN
TG	TOP OF GRATE
TYP	TYPICAL

ESTIMATED STORMWATER TREATMENT REQUIREMENTS

SUBAREA#/ (DMA#)	AREA (AC)	IMPERVIOUSNESS	TREATMENT FLOW REQUIREMENT (CFS) PER OC STANDARDS	DESIGN FLOW RATE (80% x 1.5) (CFS)	MWS MODEL (FTxFT) STD HGL=3.4'	BMP TREATMENT CAPACITY (CFS)
A1 (DMA 1)	1.16	85%	0.238	0.356	8'x16'	0.462
A2 (DMA 2)	0.81	85%	0.166	0.249	8'x12'	0.462
B1 (DMA 3)	0.41	95%	0.092	0.138	4'x13'	0.144
C1 (DMA 4)	0.33	85%	0.068	0.101	4'x8'	0.115
C2 (DMA 5)	1.12	100%	0.262	0.393	8'x16'	0.462
C3 (DMA 6)	0.73	85%	0.150	0.224	8'x8'	0.231
C4 (DMA 7)	0.96	85%	0.197	0.295	8'x12'	0.346

NOTE: REFER PRELIMINARY WQMP REPORT FOR WATER QUALITY CALCULATIONS
WATER QUALITY TREATMENT ASSUMES NO SITE INFILTRATION

HYDROMODIFICATION SUSCEPTIBILITY

SITE DEEMED NOT TO BE SUBJECTED TO HYDROMODIFICATION MITIGATION MEASURES DUE TO EVENTUAL DISCHARGE TO SAN JUAN CREEK, WHICH IS AN ENGINEERED, LARGE RIVER & EXEMPTED BY THE SOUTH ORANGE COUNTY HYDROMODICATION PLAN (HMP).

EXISTING STORM DRAIN REFERENCE

CITY OF DANA POINT STORM DRAIN IMPROVEMENT IN VICTORIA BOULEVARD & SEPULVEDA AVENUE APPROVED ON 5/7/1992.

Q_{10} DESIGN IN EXISTING STORM DRAIN USED FROM THIS REFERENCE PLAN.

KEY ASSUMPTIONS

* – ASSUMES FULL CAPTURE OF 10-YEAR STORM DESIGN FROM REFERENCE AS-BUILT.

** – STREET PEAK RUNOFF CALCULATED FROM CONSERVATIVE FACTOR OF 3 CFS PER ACRE. NO ROUTING PERFORMED.

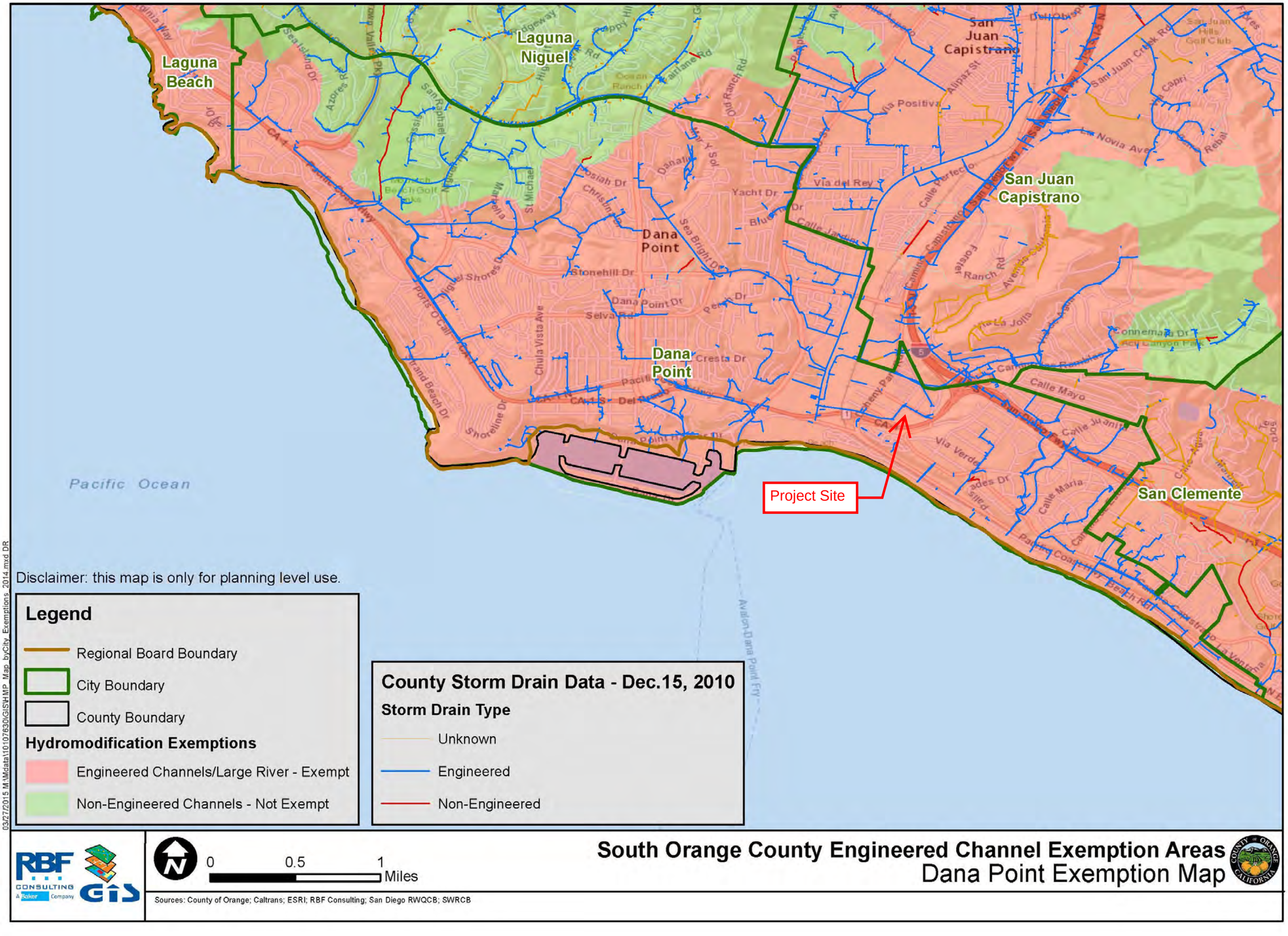
FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 • fax 949.474.5315
www.fuscoe.com

VICTORIA APARTMENTS

26126 VICTORIA BLVD, DANA POINT, CA

PROPOSED HYDROLOGY

March 8, 2022



South Orange County Engineered Channel Exemption Areas
Dana Point Exemption Map

Low Permeable Soils (Hydrogroup D)

Project Site

0 5,250 10,500 21,000 Feet

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

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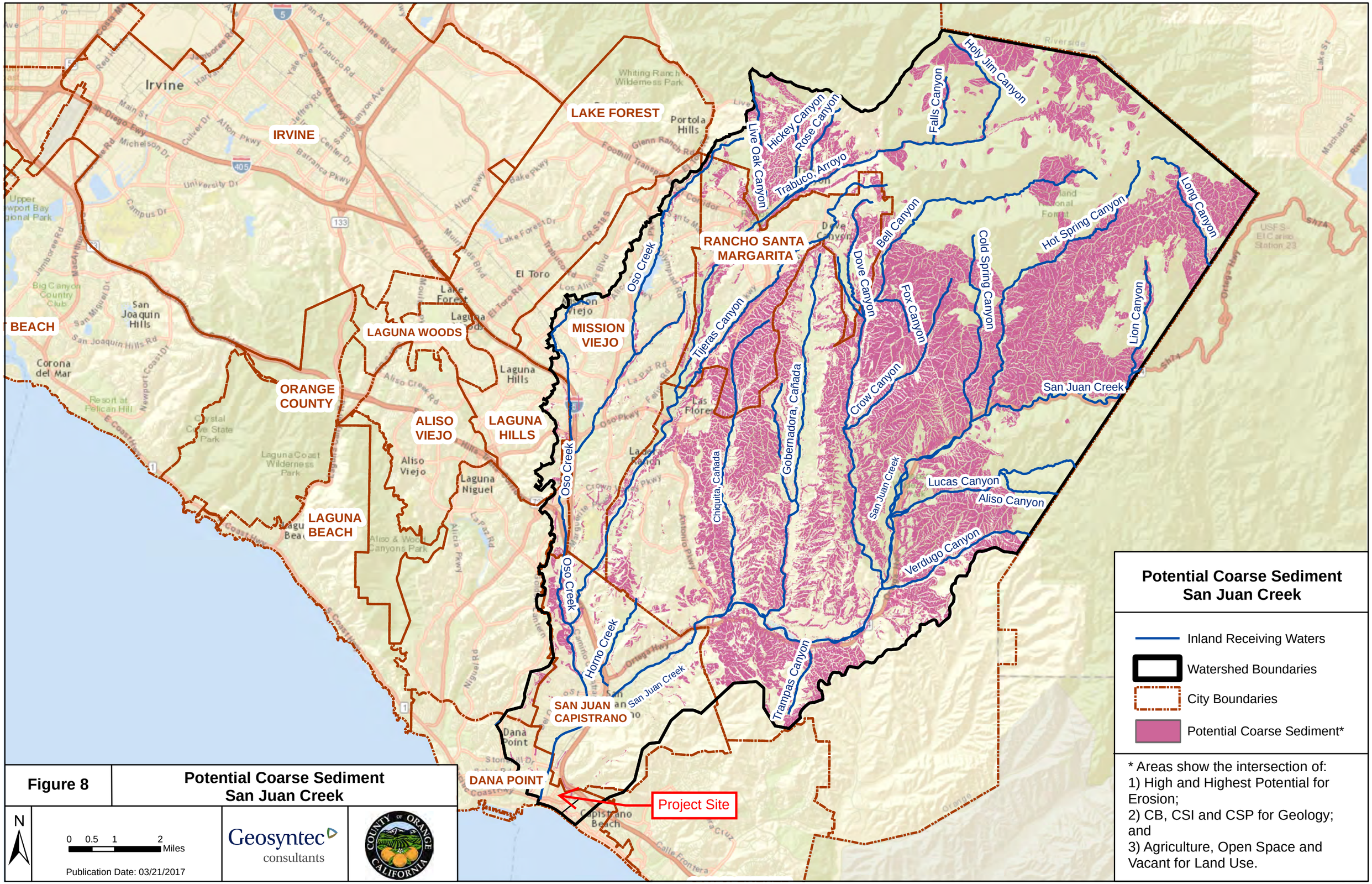
PACE Advanced Water Engineering

COUNTY OF ORANGE
WATERSHED INFILTRATION HYDROMODIFICATION MANAGEMENT PLAN (WIHMP)

FIGURE 9.9a

INFILTRATION CONSTRAINT - D SOILS (LOW PERMEABLITY) SAN JUAN CREEK WATERSHED



Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

SUBJECT TO FURTHER REVISION

LEGEND

- Orange County Precipitation Stations
- 24 Hour, 85th Percentile Rainfall (Inches)
- 24 Hour, 85th Percentile Rainfall (Inches) - Extrapolated
- City Boundaries

Rainfall Zones

Design Capture Storm Depth (inches)

- 0.65"
- 0.7
- 0.75
- 0.80
- 0.85
- 0.90
- 0.95
- 1.00
- 1.10"

Note: Events defined as 24-hour periods (calendar days) with greater than 0.1 inches of rainfall.
For areas outside of available data coverage, professional judgment shall be applied.

0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
1.05

LOS ANGELES COUNTY
ORANGE COUNTY
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY
Riverside County
San Diego County

Project Site

0 3 6 12 Kilometers
0 1.8 3.6 7.2 Miles

Pacific Ocean
San Pedro Channel

TITLE: RAINFALL ZONES

JOB: ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT — ORANGE CO. CA

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	9526-E

PACE Advanced Water Engineering

FIGURE XVI-1

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-1_RainfallZones_20110215.mxd

ATTACHMENT D

BMP DESIGN CALCULATIONS & DETAILS

Worksheet 1: Infiltration Feasibility Categorization

Categorization of Infiltration Feasibility Condition			***Page 1 of 5***
Part 1: Physical Limitations of Infiltration Based on the criteria for physical limitations of infiltration described in Section 4.2.2.2, what level of physical feasibility of infiltration is the maximum that the BMP location will support?			
	Physical Infiltration Feasibility Category	**Mark applicable category**	**Next step**
1	Full Infiltration of the DCV		Continue to Part 2
	Biotreatment with Partial Infiltration		Continue to Part 3
	Biotreatment with No Infiltration	X	Select and Utilize Biotreatment without Infiltration
Provide summary of basis: *Full and partial infiltration is considered infeasible on the project site due to several limiting site conditions. According to Section 4.2.2.3 of the TGD, full and partial infiltration of the DCV is prohibited if seasonally high groundwater or mounded groundwater is less than 5 feet below the designed bottom of the infiltration facility. As stated in Section 3.1.2.1, seasonally high groundwater is 5 feet below ground surface making infiltration infeasible.* *In addition to shallow groundwater and clayey soils, the site is also subject to liquefaction. Section 4.2.2.4 notes that full infiltration in locations less than 50 feet away from slopes steeper than 15 percent poses a significant risk. Variable slopes are present offsite and border the project site to the south east.* *Lastly, Geotracker found past contamination onsite. Although the case has been closed, past contamination and shallow groundwater are major concerns for implementing infiltration BMPs and potentially contaminating groundwater. Full and partial infiltration has been deemed infeasible. BMPs will be designed as biotreatment with no infiltration.* Summarize findings of studies, provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Categorization of Infiltration Feasibility Condition		***Page 2 of 5***	
Part 2: Risks Limiting Full Infiltration of the DCV –*Would infiltration of the full DCV introduce risks of undesirable consequences that cannot reasonably be mitigated?*		***Yes***	***No***
2	**Would infiltration of the DCV pose significant risk for groundwater related concerns?** Use criteria described in Section 4.2.2.3 and results from **Worksheet 2** (Appendix C) to describe groundwater-related infiltration feasibility criteria.	X	
Provide basis: *There is a LUST Cleanup Site within 250 feet of the project site. CUSD Transportation Yard (T0605902398) was discovered to have leaking underground storage tanks and was reported in December of 1989. The main contaminant of concern was gasoline and it posed a threat to other groundwater (uses other than drinking water such as municipal, agricultural, and industrial). The petroleum release was remediated and the case was closed as of July 26, 2000.* *Review of the Seismic Hazard Zone Report for the Dana Point 7.5 Minute Quadrangle (California Division of Mines and Geology [CDMG], 2001) indicates the historically highest groundwater level in the area is approximately 5 feet beneath the ground surface.* 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 full DCV pose significant risk of increasing risk of geotechnical hazards that cannot be mitigated to an acceptable level**? Use criteria described in Section 4.2.2.4.	X	
Provide basis: *Overall, the geotechnical conditions of the project site are not favorable to infiltration. In addition to poor infiltrating soils, the State of California Seismic Hazard Zone Map for the Dana Point Quadrangle (CDMG, 2001) indicates that the site is located within an area designated as having a potential for liquefaction, mostly likely due to shallow groundwater levels, a primary factor controlling liquefaction. Liquefaction is a phenomenon in which loose, saturated, relatively cohesionless soil deposits lose shear strength during strong ground motions.* Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

4	Would infiltration of the DCV cause an increase in groundwater flow or decrease in surface runoff over predevelopment conditions that would cause **impairment to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?** Use criteria in Section 4.2.2.5		X

Provide basis:

Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

Categorization of Infiltration Feasibility Condition		***Page 3 of 5***	
Part 2 (continued): Risks Limiting Full Infiltration of the DCV –*Would infiltration of the full DCV introduce risks of undesirable consequences that cannot reasonably be mitigated?*		***Yes***	***No***
5	Is there substantial evidence that infiltration of the DCV would **result in a significant increase in I&I to the sanitary sewer** that cannot be sufficiently mitigated?		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 infiltration of the DCV **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.

Part 2 Result	If the answer to all questions 2-6 are “No”, then the DMA is categorized as “Full Infiltration” for the purposes of LID BMP type selection. Describe finding. At the Preliminary/Conceptual WQMP phase, describe the additional design-phase testing required to confirm this determination and identify contingencies for final design. At the Final Project WQMP phase, identify any required construction-phase testing and identify the design contingencies that should result based on construction-phase testing. If the answer to any of questions 2-6 is “Yes” then the site cannot be categorized as “Full Infiltration”. Continue to Part 3: Partial Infiltration Feasibility		
Categorization of Infiltration Feasibility Condition		***Page 4 of 5***	
Part 3: Partial Infiltration Feasibility Criteria –*Would infiltration of any appreciable volume of stormwater result in risks of undesirable consequences that cannot reasonably be mitigated?*		***Yes***	***No***
8	**Would use of biotreatment BMPs with partial infiltration pose significant risk for groundwater related concerns?** Refer to criteria in Section 4.2.2.3 and Worksheet 1 (Appendix C) for guidance on groundwater-related infiltration feasibility criteria.	X	
Provide basis: *According to Section 4.2.2.3 of the TGD, full and partial infiltration of the DCV is prohibited if seasonally high groundwater or mounded groundwater is less than 5 feet below the designed bottom of the infiltration facility. Seasonally high groundwater or mounded groundwater is less than 5 feet below the designed bottom of the infiltration facility. Review of the Seismic Hazard Zone Report for the Dana Point 7.5 Minute Quadrangle (California Division of Mines and Geology [CDMG], 2001) indicates the historically highest groundwater level in the area is approximately 5 feet beneath the ground surface.* Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
9	**Would the use of biotreatment BMPs with partial infiltration pose elevated risks of geotechnical hazards that cannot be mitigated to an acceptable level**? Refer to Section 4.2.2.4.		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

10	**Would the use of biotreatment BMPs with partial infiltration elevate risks or introduced conflicts related to groundwater balance, inflow and infiltration, or water rights?** Refer to Section 4.2.2.5. Note: this is uncommon and must be supported by site-specific analysis if it is used as a basis to reject biotreatment with partial infiltration.		X
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Categorization of Infiltration Feasibility Condition		***Page 5 of 5***	
Part 3 Result	If the answer to all questions 8-10 are “No”, then the DMA is categorized as “Biotreatment with Partial Infiltration” for the purposes of LID BMP type selection. If the answer to any of questions 8-10 is “Yes” then the site is categorized as “Biotreatment with No Infiltration” for the purposes of LID BMP type selection.	Biotreatment with No Infiltration	

Harvest & Reuse Irrigation Demand Calculations

Storm Water Design Capture Volume (SQDV)

Drainage Area / Land Use Type	Impervious Area (ac)	Irrigated Area (ac)	% impervious	Runoff Coefficient	Design Storm Depth (in)	Drainage Area (acres)	DCV (ft^3)	DCV (gal)
Total Site	4.90	0.62	89%	0.818	0.80	5.520	**13,112.6**	**98,082**
				#REF!			**#REF!**	**#REF!**
				#REF!			**#REF!**	**#REF!**
				#REF!			**#REF!**	**#REF!**
				#REF!			**#REF!**	**#REF!**
				#REF!			**#REF!**	**#REF!**

	Eto
Irvine	3.00
Laguna Beach	2.75
Santa Ana	2.93

Modified

$$EAWU = \frac{Eto \times KL \times LA \times 0.015}{IE}$$

$$EIATA = \frac{LA \times KL}{(IE \times \text{Tributary Imp. Area})}$$

Blend of High-Use and Low-Use Landscaping

Drainage Area / Land Use Type	Total Area (ac)	Total Area (sf)	% Impervious	Impervious (sf)	Pervious / LA (sf)	Eto	KL	Modified EAWU	EAWU/ Impervious Acre	EIATA	Minimum EIATA (interpo-lated)	Drawdown of DCV (days)	Drawdown of DCV (hours)	Is Drawdown of DCV <48 hours?
Total Site	5.520	240,451	89%	214,002	26,450	2.75	0.55	666.75	135.72	0.08	0.00	147.1	3,531	No
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!	#DIV/0!	0.00	#REF!	#REF!	

Source: Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs) in South Orange County. September 28, 2017. Appendix F.

Worksheet 9: Flow-Based Compact Biofiltration with Supplemental Retention Method

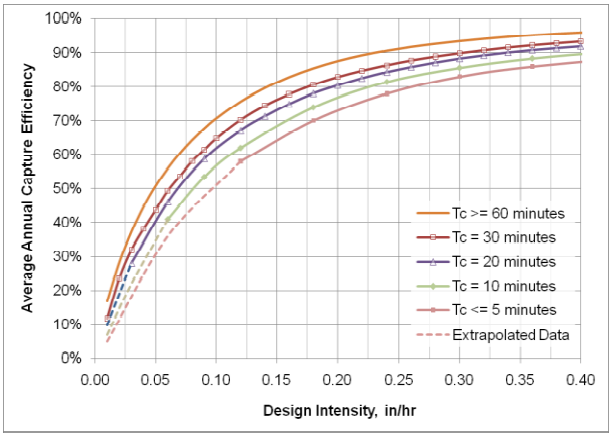
		DMA =	DMA 1	DMA 2	DMA 3	DMA 4	DMA 5	DMA 6	DMA 7	
Part 1: Determine the design storm intensity of the compact biofiltration BMP										
1	Enter the time of concentration, T_c (min) (See E.2.3) (account for upstream detention by increasing Tc to a maximum 60 minutes per Section E.3.5.2 if detention is provided)	T_c=	5	5	5	5	5	5	5	min
2	Using Figure E-7 or the figure included in the worksheet, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.26	0.26	0.26	0.26	0.26	0.26	0.26	in/hr
3	Enter capture efficiency corresponding to upstream HSCs and/or upstream BMPs, Y_2. Attach associated calculations.	Y_2 =	0	0	0	0	0	0	0	%
4	Using Figure E-7, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	0	0	0	0	0	0	0	in/hr
5	Determine the design intensity that must be provided by BMP to achieve 80 percent capture, I_{design}= I_1-I_2	$I_{design\_80\%}$=	0.26	0.26	0.26	0.26	0.26	0.26	0.26	in/hr
Part 2: Calculate the design flowrate of the compact biofiltration BMP (Section E.2.6)										
6a	Enter DMA area tributary to BMP (s), *A* (acres)	A=	1.16	0.81	0.41	0.33	1.1	0.74	0.97	acres
6b	Enter DMA Imperviousness, imp (unitless)	imp=	85%	85%	95%	85%	100%	85%	85%	
6c	Calculate runoff coefficient, *c= (0.75 x imp) + 0.15*	c=	0.788	0.788	0.863	0.788	0.900	0.788	0.788	
6d	Calculate flowrate to achieve 80 percent capture, $Q_{80\%}$ = *(c x I_{design} x A)*	$Q_{80\%}$=	0.238	0.166	0.092	0.068	0.257	0.152	0.199	cfs
7	Calculate design flowrate, Q_{design} = $Q_{80\%}$ *x 150%*	Q_{design}=	0.356	0.249	0.138	0.101	0.386	0.227	0.298	cfs
Part 3: Demonstrate that Supplemental Retention BMPs Conform to Volume Reduction Targets (Only DMAs Categorized as "Biotreatment with Partial Infiltration")										
8	Describe system, including features to maximize volume reduction (if applicable):									
	Proprietary BioTreatment (BIO-7):									
	Unit Size / Model =		*MWS-L-8-16*	*MWS-L-8-12*	*MWS-L-4-13*	*MWS-L-4-8*	*MWS-L-8-16*	*MWS-L-8-8*	*MWS-L-8-12*	
	Unit Size / Model Treatment Capacity =		*0.462*	*0.346*	*0.144*	*0.115*	*0.462*	*0.231*	*0.346*	cfs
	Number of Units Needed =		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
	Total Bio-treatment Provided =		*0.462*	*0.346*	*0.144*	*0.115*	*0.462*	*0.231*	*0.346*	cfs
9	Summarize calculations to demonstrate that volume reduction targets are met, where feasible and applicable.									

Supporting Calculations

Provide time of concentration assumptions:

Assumed conservative Tc of 5 min

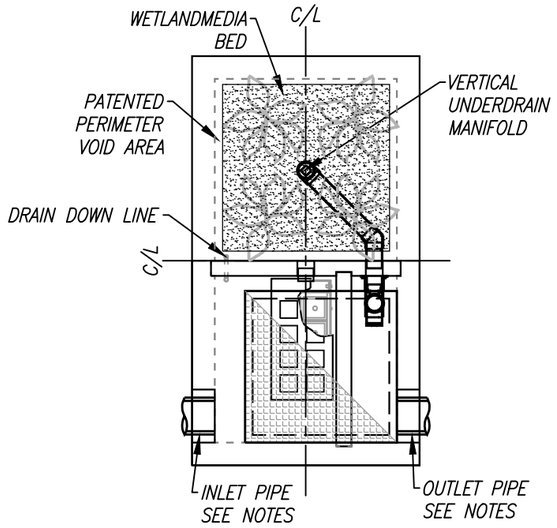
Graphical Operations



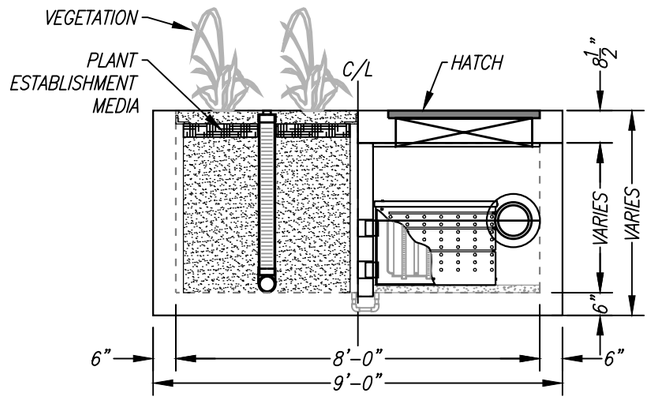
Provide supporting graphical operations in figure above.

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID		MWS #4	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.115	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	36" X 36"	OPEN PLANTER	N/A
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



LEFT END VIEW

INSTALLATION NOTES

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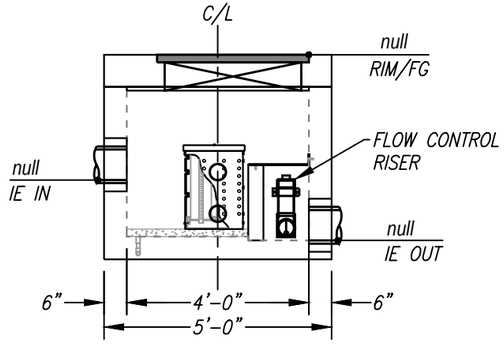
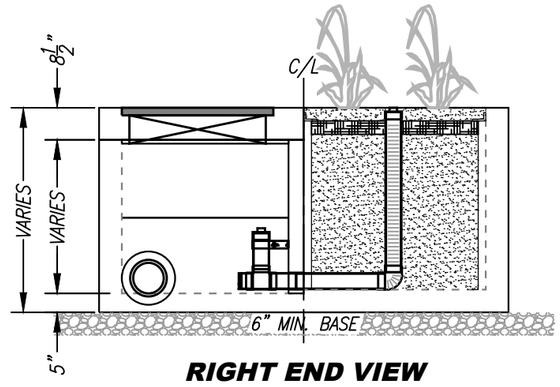


ELEVATION VIEW



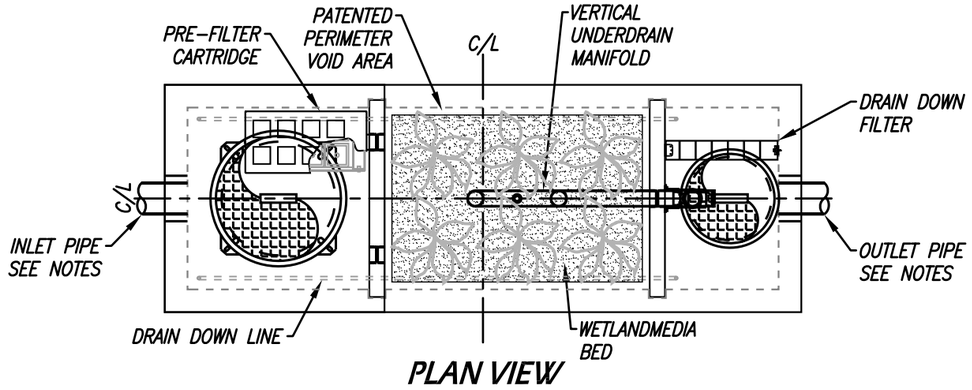
RIGHT END VIEW

TREATMENT FLOW (CFS)	0.115
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

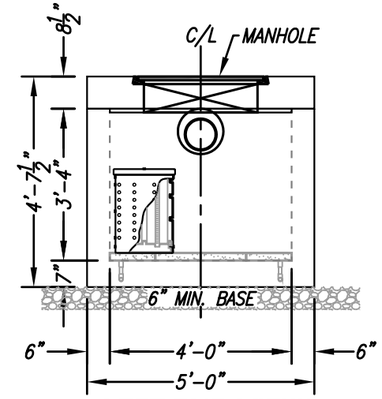
MWS-L-4-8-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

5/23/19 10:LEF

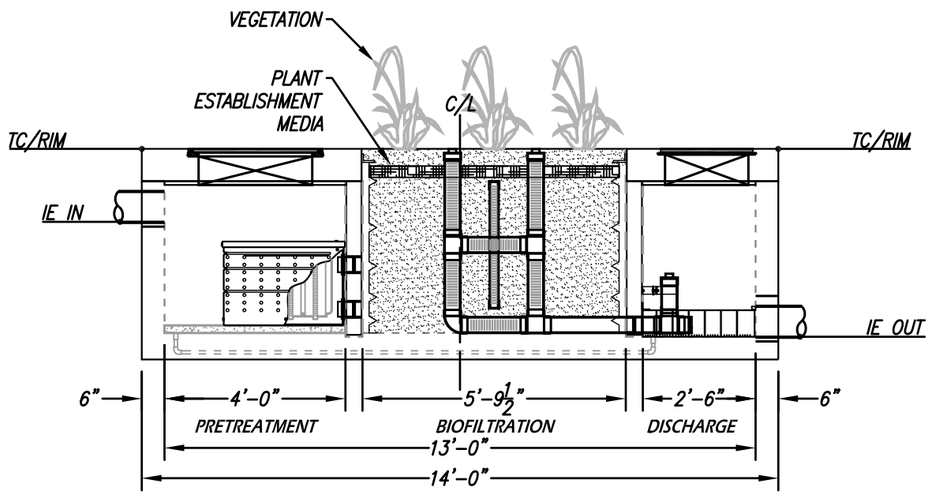
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID		MWS #3	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			3.05
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.71"
MAXIMUM PICK WEIGHT (LBS)			27000
NOTES:			



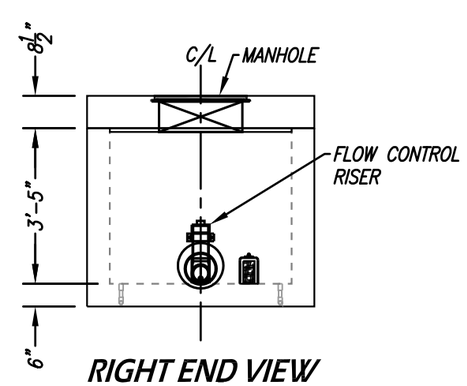
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



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TREATMENT FLOW (CFS)	0.144
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MODULAR WETLANDS
www.ModularWetlands.com | (855) 5MOD-WET

MWS-L-4-13-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID		MWS #6	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.231	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	ø30"	OPEN PLANTER	ø24"
NOTES:			

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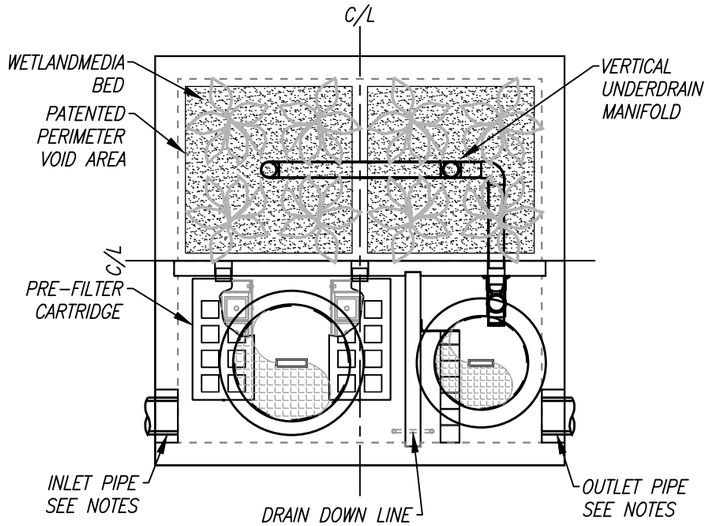
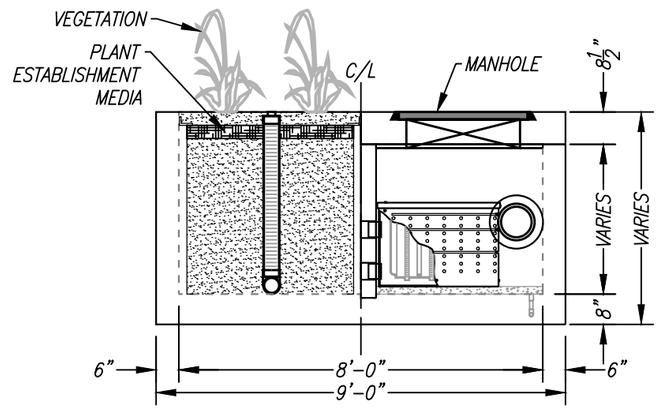


PLAN VIEW



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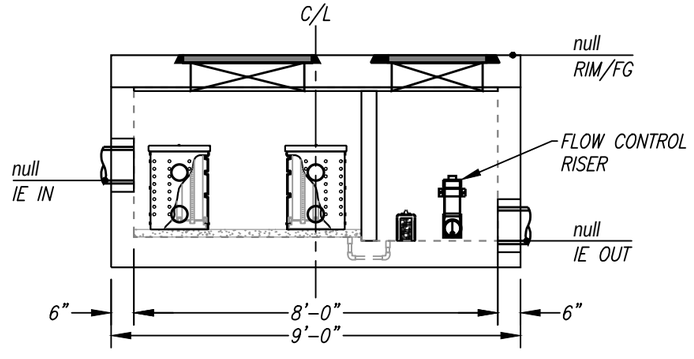
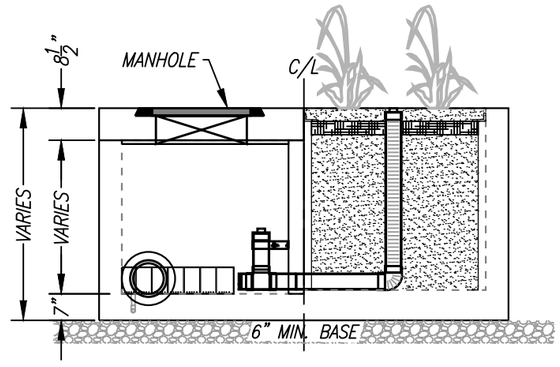


ELEVATION VIEW



RIGHT END VIEW

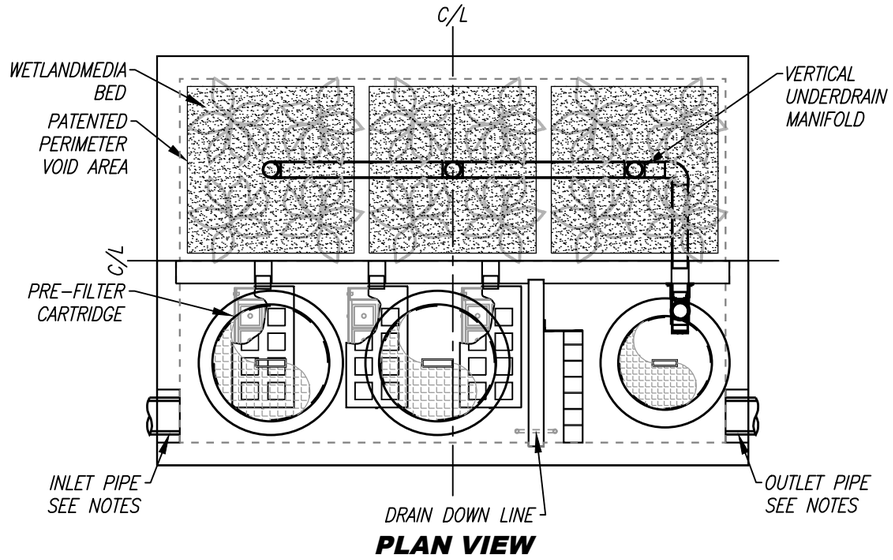
TREATMENT FLOW (CFS)	0.231
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-8-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

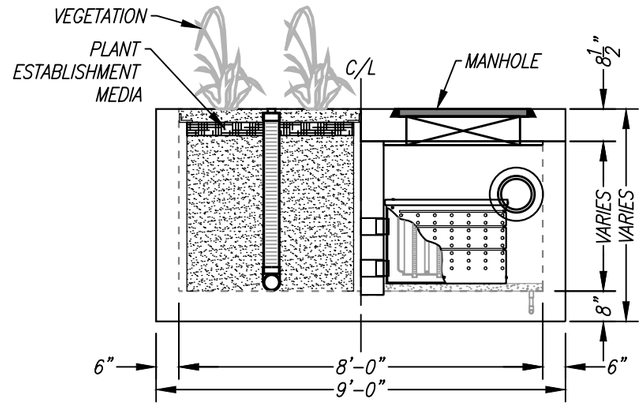
5/23/19 10:LEF

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID		MWS #7 and MWS #2	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.346	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	2EA ø30"	OPEN PLANTER	ø24"
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



LEFT END VIEW

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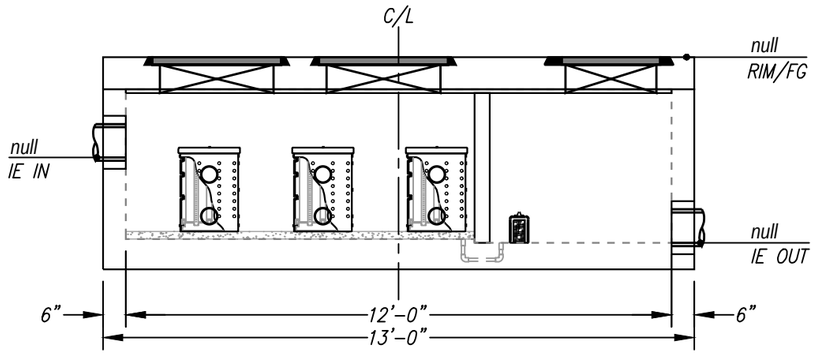
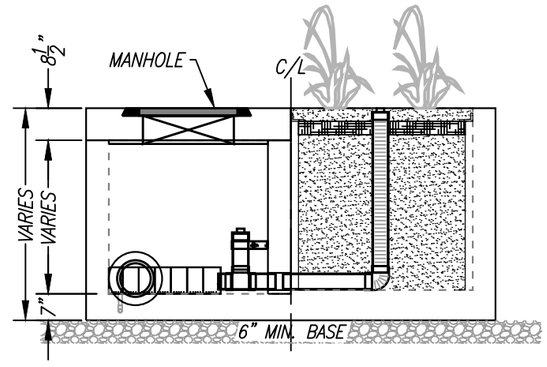


ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.346
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-12-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

5/23/19 10:LEF

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID		MWS #1 and MWS #5	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.462	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	2EA ø30"	OPEN PLANTER	ø24"
NOTES:			

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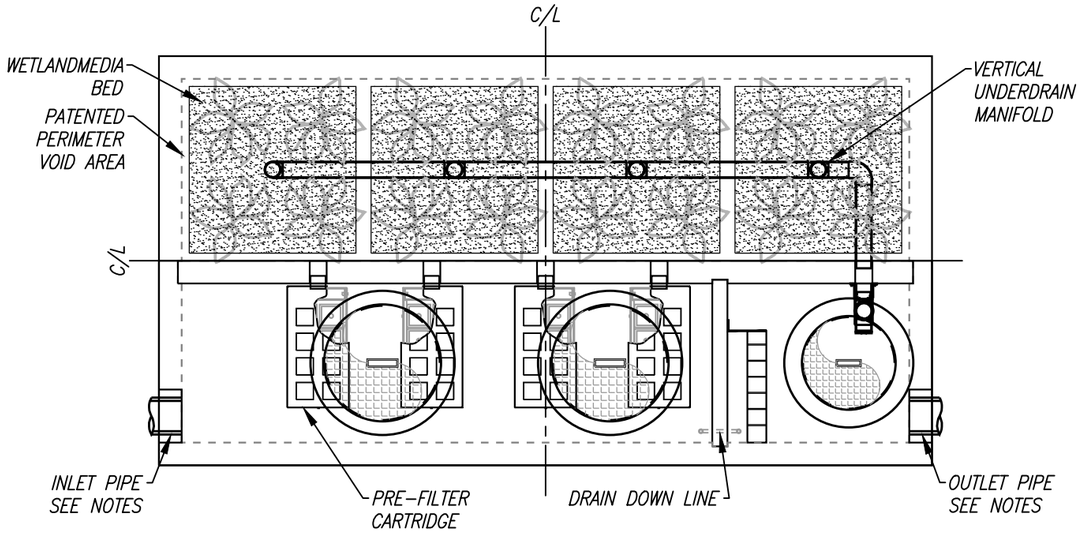
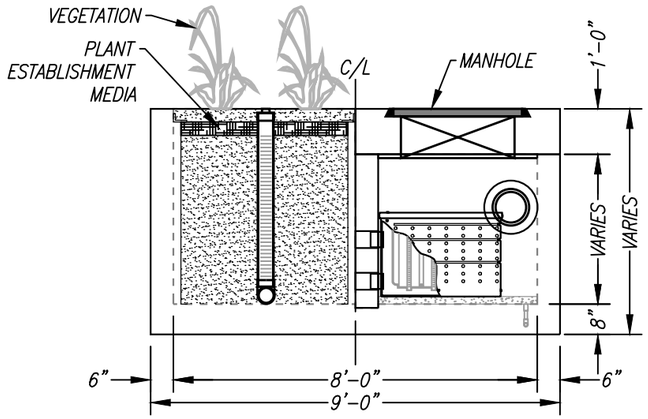


PLAN VIEW



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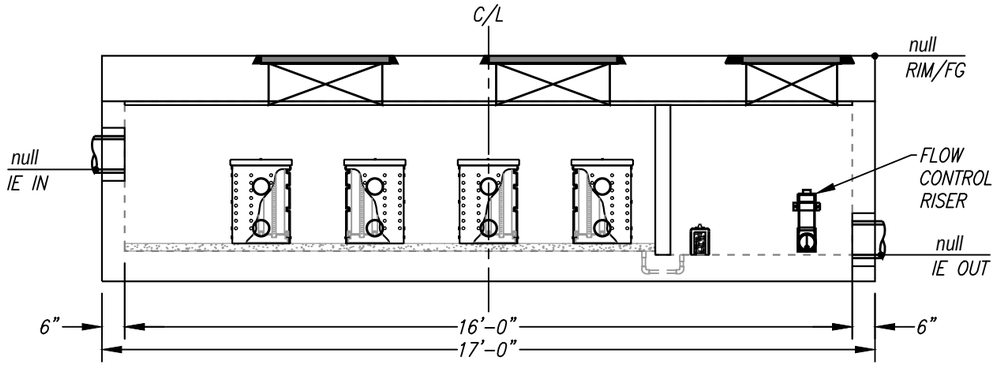
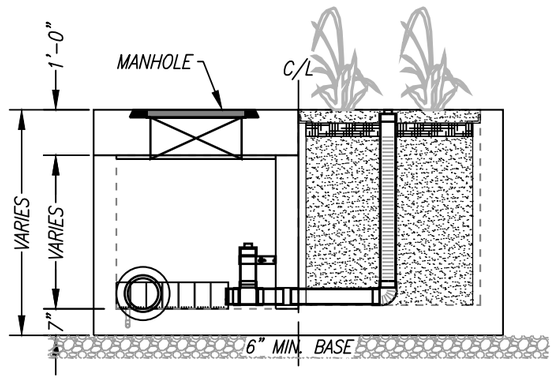


ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.462
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-16-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

5/23/19 10:LEF

ATTACHMENT E

CONDITIONS OF APPROVAL (PENDING ISSUANCE)

ATTACHMENT F

GEOTECHNICAL REPORT

DUE-DILIGENCE GEOTECHNICAL INVESTIGATION

PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT 26126 VICTORIA BOULEVARD DANA POINT, CALIFORNIA

PREPARED FOR

TOLL BROTHERS APARTMENT LIVING
IRVINE, CALIFORNIA

PROJECT NO. A9942-88-01

MARCH 15, 2019

GEOCON
WEST, INC.
GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

Project No. A9942-88-01
March 15, 2019

Toll Brothers Apartment Living
200 Spectrum Center Drive, Suite 300
Irvine, California 92618

Attention: Mr. John Hyde

Subject: DUE-DILIGENCE GEOTECHNICAL INVESTIGATION
VICTORIA BOULEVARD APARTMENTS
MULTI-FAMILY RESIDENTIAL DEVELOPMENT
26126 VICTORIA BOULEVARD, DANA POINT, CALIFORNIA

Dear Mr. Hyde:

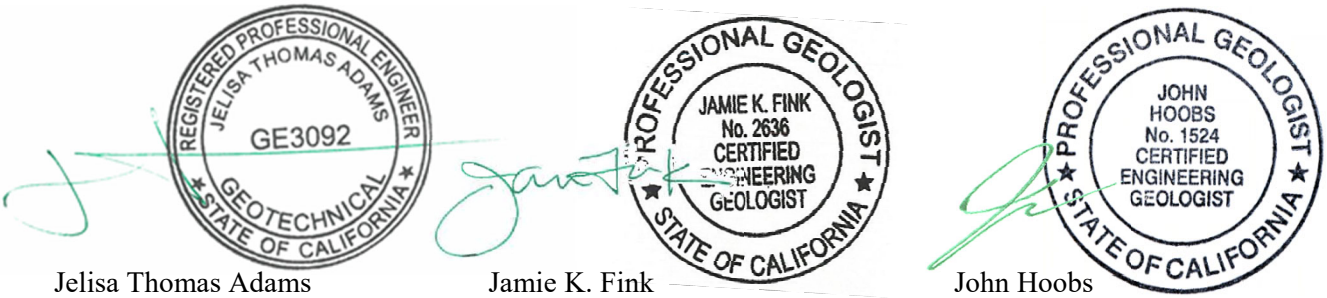
In accordance with your authorization of our proposal dated January 29, 2019, we have performed a due-diligence geotechnical investigation for the proposed Victoria Boulevard Apartments development located at 26126 Victoria Boulevard in the City of Dana Point, California. The accompanying report presents the findings of our study, and our conclusions and recommendations pertaining to the geotechnical aspects of proposed design and construction. Based on the results of our investigation, it is our opinion that the site can be developed as proposed.

The primary intent of this study was to address potential geologic hazards and geotechnical conditions that could impact the project. As the project design progresses, updated geotechnical recommendations should be provided for design and construction.

If you have any questions regarding this report, or if we may be of further service, please contact the undersigned.

Very truly yours,

GEOCON WEST, INC.



Jelisa Thomas Adams
GE 3092

Jamie K. Fink
CEG 2636

John Hoobs
CEG 1524

(EMAIL) Addressee

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

DUE-DILIGENCE GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of a due-diligence geotechnical investigation for the proposed Victoria Boulevard Apartments development located at 26126 Victoria Boulevard, Dana Point, California (see Vicinity Map, Figure 1). The purpose of the due-diligence investigation was to develop an understanding of the soil and groundwater conditions at the site as well as potential geologic and seismic hazards that may affect development of the subject site. As the project design progresses, updated geotechnical recommendations should be provided for design and construction.

The scope of this investigation included a site reconnaissance, field exploration, laboratory testing, engineering analysis, and the preparation of this report. The site was explored on February 25, 2019, by excavating five 8-inch diameter borings to depths between 31½ and 51½ feet below the existing ground surface using a truck-mounted hollow-stem auger drilling machine. On February 27, 2019, five CPTs were advanced to depths between 90 and 100 feet below the existing ground surface. The approximate locations of the exploratory borings and CPTs are depicted on the Site Plan (see Figure 2). A detailed discussion of the field investigation, including boring and CPT logs, is presented in Appendix A.

Laboratory tests were performed on selected soil samples obtained during the investigation to determine pertinent physical and chemical soil properties. Appendix B presents a summary of the laboratory test results.

The recommendations presented herein are based on analysis of the data obtained during the investigation and our experience with similar soil and geologic conditions. References reviewed to prepare this report are provided in the *List of References* section.

If project details vary significantly from those described herein, Geocon should be contacted to determine the necessity for review and possible revision of this report.

2. SITE AND PROJECT DESCRIPTION

The subject site is located at 26126 Victoria Boulevard in the City of Dana Point, California. The 5.52-acre lot is irregular in shape and is bounded by Victoria Boulevard to the north, an approximate 12 to 45-feet high ascending cutslope to the south and east, and by Sepulveda Avenue to the west. The existing development in the site vicinity consists of one and two-story residential and commercial structures. The property is currently occupied by the Capistrano School District Maintenance and Bus Yard which consists of several relatively small single-story buildings scattered throughout the property and abundant parking areas and storage bins. The site is very gently sloping to the northwest with approximately 12 feet of vertical relief across the property. The existing slope which bounds the site to the south and east is generally inclined at a gradient of 2:1 (H:V) and flatter. Surface water drainage at the site appears to be by sheet flow along the existing ground contours to the city streets. The site is covered predominately with asphalt and concrete.

It is our understanding that the proposed development will include 5-story apartment buildings wrapped around a 6.5-story parking structure to be constructed at or near present grade. Additional site improvements will include courtyards, landscape areas, a swimming pool, and driveways. The proposed development is depicted on the Site Plan (see Figure 2).

Based on the preliminary nature of the design at this time, wall and column loads were not available. Column loads and wall loads for the proposed parking structure are estimated be up to 650 kips and 35 kips per linear foot, respectively. Column loads and wall loads for the proposed apartment building are estimated be up to 150 kips and 6 kips per linear foot, respectively.

We understand that final design of the project has not been completed, hence, once the design phase proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary. Any changes in the design, location or elevation of any structure, as outlined in this report, should be reviewed by this office. Geocon should be contacted to determine the necessity for review and possible revision of this report.

3. GEOLOGIC SETTING

The site is situated in the northwestern portion of the Peninsular Ranges geomorphic province characterized by fault block northwest trending mountain ranges with intervening valleys, plains and basins. The site is located in the middle of the Dana Point 7.5-minute Quadrangle Sheet and at the southern terminus of the locally rugged San Joaquin Hills (CDMG, 1999 and Edington, 1974). The prominent structural feature within the San Joaquin Hills includes the gentle folding of the geologic units into a broad, north-trending syncline. Geologically, the site is situated approximately 2000-feet east-southeast of the mouth of the San Juan Creek and within the alluvial plain. The geologic units in the area consist of Holocene alluvium overlying Tertiary marine and nonmarine sedimentary strata ranging in age from late Miocene to early Pliocene.

The geologic formation that is present on site is the flat lying Holocene-age stream alluvial deposits, which is underlain, at depth, by Capistrano Formation. Regional faulting in the area is common with active faults including the San Joaquin Hills, Newport-Inglewood, Chino, Elsinore, and others that could influence the site.

4. SOIL AND GEOLOGIC CONDITIONS

Based on our field investigation and published geologic maps of the area, the site is underlain by artificial fill, Holocene age stream alluvial deposits, and ultimately, at depth, by late Miocene to early Pliocene Capistrano Formation. Detailed stratigraphic profiles of the materials encountered at the site are provided on the boring logs in Appendix A.

4.1 Artificial Fill

Artificial fill was encountered in our field explorations to a maximum depth of 5 feet below existing ground surface. The artificial fill generally consists of brown, gray brown, and reddish brown, sandy silty clay, clayey silt, and clayey silty sand. The artificial fill is characterized as slightly moist to moist and soft to firm or loose. The fill is likely the result of past grading or construction activities at the site. Deeper fill may exist between excavations and in other portions of the site that were not directly explored.

We understand that previously abandoned underground storage tanks were removed from the northeast most corner of the site. Based on available information, the prior excavations extended to depths of up to 29 feet below the ground surface. We have not been provided with documentation that the excavations were backfilled with certified, engineered fill. Therefore, the backfill material should be considered as undocumented artificial fill.

4.2 Alluvium

Holocene age alluvial stream deposits were encountered beneath the fill. The alluvial stream deposits consist of brown to dark brown to gray to olive brown, interbedded sandy clayey silt, silty clay, and clayey sand. The alluvium is characterized as slightly moist to wet and very soft to firm and medium dense.

4.3 Capistrano Formation (Tc)

Tertiary-age Capistrano Formation was encountered in Borings B-1, B-2, and B-5 at depths of approximately 40, 25, and 35 feet below the existing ground surface, respectively. Where encountered, the bedrock consists of clayey and sandy siltstone and silty sandstone. In general, the unit generally consists of a stiff to hard siltstone to claystone that is highly expansive.

5. GROUNDWATER

Review of the Seismic Hazard Zone Report for the Dana Point 7.5 Minute Quadrangle (California Division of Mines and Geology [CDMG], 2001) indicates the historically highest groundwater level in the area is approximately 5 feet beneath the ground surface.

Groundwater was encountered in our borings at depths ranging from approximately 16 to 20 feet below the existing ground surface. Considering the historic high groundwater level and the depth to groundwater observed in our borings, groundwater may be encountered during construction. It is not uncommon for groundwater levels to vary seasonally or for groundwater seepage conditions to develop where none previously existed, especially in impermeable fine-grained soils which are heavily irrigated or after seasonal rainfall. Proper surface drainage of irrigation and precipitation will be critical for future performance of the project. Recommendations for drainage are provided in the S*urface Drainage* section of this report (see Section 7.22).

6. GEOLOGIC HAZARDS

6.1 Surface Fault Rupture

The numerous faults in Southern California include active, potentially active, and inactive faults. The criteria for these major groups are based on criteria developed by the California Geological Survey (CGS, formerly known as CDMG) for the Alquist-Priolo Earthquake Fault Zone Program (CGS, 2018a). By definition, an active fault is one that has had surface displacement within Holocene time (about the last 11,700 years). A potentially active fault has demonstrated surface displacement during Quaternary time (approximately the last 1.6 million years), but has had no known Holocene movement. Faults that have not moved in the last 1.6 million years are considered inactive.

The site is not within a state-designated Alquist-Priolo Earthquake Fault Zone (CGS, 2018b). No active or potentially active faults with the potential for surface fault rupture are known to pass directly beneath the site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low. However, the site is located in the seismically active Southern California region, and could be subjected to moderate to strong ground shaking in the event of an earthquake on one of the many active Southern California faults. The faults in the vicinity of the site are shown in Figure 3, Regional Fault Map.

Localized and unnamed faults lie approximately 2000 feet and 5100 feet north and northeast of the site, respectively (Edington, 1974). Recent activity on these faults have not been established within the last 11,700 years, consequently, they are not considered active. The closest surface trace of an active fault to the site is the Newport-Inglewood Fault Zone located approximately 2.9 miles to the southwest. Other nearby active faults are the Elsinore Fault Zone and the Palos Verdes Fault (Offshore Segment) located approximately 22 miles northeast and 17 miles southwest of the site, respectively. Strong ground motion could also be expected from earthquakes occurring along the San Jacinto and San Andreas fault zones which lie northeast of the site at distances of approximately 45-miles and 56-miles, respectively. The San Clemente fault, which lies approximately 58-miles southwest of the site, as well as numerous other offshore faults, could also provide strong ground motion.

Several buried thrust faults, commonly referred to as blind thrusts, underlie the Los Angeles Basin (including the Orange County Coastal Plain) at depth. These faults are not exposed at the ground surface and are typically identified at depths greater than 3.0 kilometers. The October 1, 1987, M_w 5.9 Whittier Narrows earthquake and the January 17, 1994, M_w 6.7 Northridge earthquake were a result of movement on the Puente Hills Blind Thrust and the Northridge Thrust, respectively. The San Joaquin Thrust underlies the site at depth. This thrust fault and others in the greater Los Angeles/Orange County area are not exposed at the surface and do not present a potential surface fault rupture hazard at the site; however, these deep thrust faults are considered active features capable of generating future earthquakes that could result in moderate to significant ground shaking at the site.

6.2 Seismicity

As with all of Southern California, the site has experienced historic earthquakes from various regional faults. The seismicity of the region surrounding the site was formulated based on research of an electronic database of earthquake data. The epicenters of recorded earthquakes with magnitudes equal to or greater than 5.0 in the site vicinity are depicted on Figure 4, Regional Seismicity Map. A partial list of moderate to major magnitude earthquakes that have occurred in the Southern California area within the last 100 years is included in the following table.

LIST OF HISTORIC EARTHQUAKES

Earthquake (Oldest to Youngest)	Date of Earthquake	Magnitude	Distance to Epicenter (Miles)	Direction to Epicenter
Near Redlands	July 23, 1923	6.3	44	NE
Long Beach	March 10, 1933	6.4	20	WNW
Tehachapi	July 21, 1952	7.5	131	NW
San Fernando	February 9, 1971	6.6	77	NW
Whittier Narrows	October 1, 1987	5.9	47	NW
Sierra Madre	June 28, 1991	5.8	58	NNW
Landers	June 28, 1992	7.3	87	NE
Big Bear	June 28, 1992	6.4	70	NE
Northridge	January 17, 1994	6.7	71	NW
Hector Mine	October 16, 1999	7.1	112	NE

The site could be subjected to strong ground shaking in the event of an earthquake. However, this hazard is common in Southern California and the effects of ground shaking can be mitigated if the proposed structures are designed and constructed in conformance with current building codes and engineering practices.

6.3 Seismic Design Criteria

The following table summarizes summarizes site-specific design criteria obtained from the 2016 California Building Code (CBC; Based on the 2015 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The data was calculated using the computer program *U.S. Seismic Design Maps*, provided by the USGS. The short spectral response uses a period of 0.2 second. We evaluated the Site Class based on the discussion in Section 1613.3.2 of the 2016 CBC and Table 20.3-1 of ASCE 7-10. The values presented in the table on the following page are for the risk-targeted maximum considered earthquake (MCE_R).

2016 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2016 CBC Reference
Site Class	D	Section 1613.3.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	1.391g	Figure 1613.3.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.523g	Figure 1613.3.1(2)
Site Coefficient, F_A	1.0	Table 1613.3.3(1)
Site Coefficient, F_V	1.5	Table 1613.3.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	1.391g	Section 1613.3.3 (Eqn 16-37)
Site Class Modified MCE_R Spectral Response Acceleration – (1 sec), S_{M1}	0.784g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.927g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.523g	Section 1613.3.4 (Eqn 16-40)

The table below presents the mapped maximum considered geometric mean (MCE_G) seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10.

ASCE 7-10 PEAK GROUND ACCELERATION

Parameter	Value	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.553g	Figure 22-7
Site Coefficient, F_{PGA}	1.0	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.553g	Section 11.8.3 (Eqn 11.8-1)

The Maximum Considered Earthquake Ground Motion (MCE) is the level of ground motion that has a 2 percent chance of exceedance in 50 years, with a statistical return period of 2,475 years. According to the 2016 California Building Code and ASCE 7-10, the MCE is to be utilized for the evaluation of liquefaction, lateral spreading, seismic settlements, and it is our understanding that the intent of the Building code is to maintain "Life Safety" during a MCE event. The Design Earthquake Ground Motion (DE) is the level of ground motion that has a 10 percent chance of exceedance in 50 years, with a statistical return period of 475 years.

Deaggregation of the MCE peak ground acceleration was performed using the USGS online Unified Hazard Tool, 2008 Conterminous U.S. Dynamic edition. The result of the deaggregation analysis indicates that the predominant earthquake contributing to the MCE peak ground acceleration is characterized as a 6.72 magnitude event occurring at a hypocentral distance of 11.35 kilometers from the site.

Deaggregation was also performed for the Design Earthquake (DE) peak ground acceleration, and the result of the analysis indicates that the predominant earthquake contributing to the DE peak ground acceleration is characterized as a 6.68 magnitude occurring at a hypocentral distance of 21.2 kilometers from the site.

Conformance to the criteria in the above tables for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

6.4 Liquefaction Potential

Liquefaction is a phenomenon in which loose, saturated, relatively cohesionless soil deposits lose shear strength during strong ground motions. Primary factors controlling liquefaction include intensity and duration of ground motion, gradation characteristics of the subsurface soils, in-situ stress conditions, and the depth to groundwater. Liquefaction is typified by a loss of shear strength in the liquefied layers due to rapid increases in pore water pressure generated by earthquake accelerations.

The current standard of practice, as outlined in the "Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California" and "Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California" requires liquefaction analysis to a depth of 50 feet below the lowest portion of the proposed structure. Liquefaction typically occurs in areas where the soils below the water table are composed of poorly consolidated, fine to medium-grained, primarily sandy soil. In addition to the requisite soil conditions, the ground acceleration and duration of the earthquake must also be of a sufficient level to induce liquefaction.

The State of California Seismic Hazard Zone Map for the Dana Point Quadrangle (CDMG, 2001) indicates that the site is located within an area designated as having a potential for liquefaction.

Liquefaction analysis of the soils underlying the site was performed using an updated version of the spreadsheet template LIQ2_30.WQ1 developed by Thomas F. Blake (1996). This program utilizes the 1996 NCEER method of analysis. This semi-empirical method is based on a correlation between values of Standard Penetration Test (SPT) resistance and field performance data.

Screening criteria presented by Bray and Sancio (2006) was used to evaluate the liquefaction susceptibility of the fine-grained soils encountered in the boring. Based on these screening criteria, fine-grained soils with a plasticity index of greater than 18 and fine-grained soils with a plasticity index of greater than 12 and a saturated water content of less than 85 percent of the liquid limit are considered not susceptible to liquefaction. Laboratory test results used for the screening criteria are presented as Figures B7 and B8.

The liquefaction analysis was performed for a Design Earthquake level by using a historic high groundwater table of 5 feet below the ground surface, a magnitude 6.68 earthquake, and a peak horizontal acceleration of 0.369g ($⅔PGA_M$). The enclosed liquefaction analyses, included herein for boring B4, indicate that the alluvial soils below the historic high groundwater would not be susceptible to liquefaction induced settlement during Design Earthquake ground motion (see enclosed calculation sheets, Figures 5 and 6).

A comparative analysis was also performed by using select CPTs and the program CLiq (Version 2.2). This program utilizes the Boulanger & Idriss (2014) method of analysis, and the same values for the historic high water table, earthquake magnitude, and peak ground acceleration as indicated above.

Based on the analyses of CPT-1 through CPT-5, subsequent to the recommended grading the alluvial soils below the historic high groundwater depth may be susceptible to less than ½ inch of settlement during Design Earthquake ground motion (see enclosed settlement report, Figure 7).

Given that the CPTs generate a continuous soil profile, and that the driven samples in the borings may not capture thin layers of soils between the samples, the boring and CPT analyses appear to be in agreement regarding the general magnitude of potential liquefaction settlement during Design Earthquake ground motion. It is recommended that the proposed project be designed for up to ½ inch of differential liquefaction induced settlement during Design Earthquake ground motion.

It is our understanding that the intent of the Building Code is to maintain "Life Safety" during Maximum Considered Earthquake level events. Therefore, additional analysis was performed to evaluate the potential for liquefaction during a MCE event. The structural engineer should evaluate the proposed structure for the anticipated MCE liquefaction induced settlements and verify that anticipated deformations would not cause the foundation system to lose the ability to support the gravity loads and/or cause collapse of the structure.

The liquefaction analysis was also performed for the Maximum Considered Earthquake level by using a historic high groundwater table of 5 feet below the ground surface, a magnitude 6.72 earthquake, and a peak horizontal acceleration of 0.553g (PGA_M). The enclosed liquefaction analyses, included herein for boring B4, indicate that the alluvial soils below the historic high groundwater would not be susceptible to liquefaction induced settlement during Maximum Considered Earthquake ground motion (see enclosed calculation sheets, Figures 8 and 9).

Based on the analyses of CPT-1 through CPT-5, subsequent to the recommended grading the alluvial soils below the historic high groundwater depth may be susceptible to less than 1 inch of settlement during Maximum Considered Earthquake ground motion (see enclosed settlement report, Figure 10).

6.5 Slope Stability

The topography at the site is relatively flat with no pronounced highs or lows. Offsite slopes bounding the southwestern portion of the property range from 12 feet on the southwest to 45 feet at the northeast corner. The slopes are generally inclined at 2:1 (horizontal to vertical) or flatter.

The site is not located within an area identified as having a potential for seismic slope instability (CDMG, 2001). There are no known landslides near the site, nor is the site in the path of any known or potential landslides. Therefore, the potential for slope stability hazards to adversely affect the proposed development is considered low.

6.6 Tsunamis, Seiches, and Flooding

The site is located within a coastal area and therefore, tsunamis, seiches, and flooding are considered possible geologic hazards in the site vicinity. The site is not located within the tsunami inundation area (CEMA, 2009), therefore, the risk of tsunami inundation is considered unlikely.

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No major water-retaining structures are located immediately up gradient from the project site. Therefore, flooding resulting from a seismically-induced seiche is considered unlikely.

The majority of the site is within an area of minimal flooding (Zone X) as defined by the Federal Emergency Management Agency (FEMA, 2018), the northeastern most portion of the site, see Figure 11, is categorized as being in Flood Zone A. Flood Zone A, as defined by FEMA, area areas with a 1% annual change of flooding and a 26% change of flooding over the life of a 30-year mortgage. No depths of base flood elevations were provided by FEMA in these areas because detailed analyses were not performed. The Dana Point Shoreline Management Plan (Project Dimensions, 2014) does not indicate the area lies within the 100-year coastal flood event.

6.7 Oil Fields & Methane Potential

Based on a review of the California Division of Oil, Gas and Geothermal Resources (DOGGR) Well Finder Website, the site is not located within the limits of an oilfield and active oil or gas wells are not located in the immediate site vicinity (DOGGR, 2018). The closest well to the site is the Union Oil Company of California, Well Number 5, a plugged core hole, located approximately 2,650 feet to the west. However, due to the voluntary nature of record reporting by the oil well drilling companies, wells may be improperly located or not shown on the location map and undocumented wells could be encountered during construction. Any wells encountered during construction will need to be properly abandoned in accordance with the current requirements of the DOGGR.

Since the site is not located within the boundaries of a known oil field, the potential for the presence of methane or other volatile gases at the site is considered low. However, should it be determined that a methane study is required for the proposed development it is recommended that a qualified methane consultant be retained to perform the study and provide mitigation measures as necessary.

6.8 Subsidence

Subsidence occurs when a large portion of land is displaced vertically, usually due to the withdrawal of groundwater, oil, or natural gas. Soils that are particularly subject to subsidence include those with high silt or clay content. The site is not located within an area of known ground subsidence. No large-scale extraction of groundwater, gas, oil, or geothermal energy is occurring or planned at the site or in the general site vicinity. There appears to be little or no potential for ground subsidence due to withdrawal of fluids or gases at the site.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 General

7.1.1 It is our opinion that neither soil nor geologic conditions were encountered during the investigation that would preclude the construction of the proposed site improvements provided the recommendations presented herein are followed and implemented during design and construction.

7.1.2 Up to 5 feet of existing artificial fill was encountered during site exploration. Additionally, it is our understanding that deeper fill on the order of 29 feet may exist in the northeast corner of the site. Deeper fill may exist in other areas of the site that were not directly explored. It is our opinion that the existing fill, in its present condition, is not suitable for direct support of proposed foundations or slabs. The existing fill and site soils are suitable for re-use as engineered fill provided the recommendations in the Grading section of this report are followed (see Section 7.4).

7.1.3 Based on the enclosed liquefaction induced settlement calculations and subsequent to the recommended grading, it is recommended that the proposed project be designed for up to ½ inches of settlement as a result the Design Earthquake peak ground acceleration. The grading and foundation recommendations presented herein are intended to minimize and design for the effects of liquefaction settlement on proposed structures.

7.1.4 Based on the results of our laboratory testing, the existing alluvium could yield excessive static and differential settlements upon application of the foundation loads associated with the proposed parking structure. Based on this consideration, it is recommended that soil modification (e.g. rammed aggregate piers) be considered below the parking structure. Recommendations for Rammed Aggregate Piers (RAP) foundations are provided in Section 7.7.

7.1.5 Where supported on ground improvement, it is recommended that the upper 3 feet of existing site soils within the footprint of the proposed parking structure be excavated and properly compacted for foundation and slab support. The engineered fill blanket should extend at least 3 feet beyond the edge of foundations, including building appurtenances, or for a distance equal to the depth of fill below the foundations, whichever is greater. Recommendations for earthwork are provided in the *Grading* section of this report (see Section 7.4).

7.1.6 As a minimum, the upper 6 feet of existing soils within the footprint areas of the proposed apartment buildings should be excavated and properly compacted for foundation and slab support. The engineered fill blanket should extend at least 3 feet beyond the edge of foundations or for a distance equal to the depth of fill below the foundations, whichever is greater. Proposed foundations should be underlain by at least 4 feet of newly compacted engineered fill. It is recommended that the grading contractor verify the depth of all building foundations prior to commencement of site grading activities in order to correctly determine the required grading overexcavations for foundations. Deeper fill or soft soils encountered during site grading operations should be completely over-excavated as necessary at the direction of the Geotechnical Engineer. The limits of existing fill and/or soft soil removal will be verified by the Geocon representative during site grading operations.

7.1.7 Subsequent to the recommended grading, the proposed apartment buildings may be supported on a post-tensioned foundation system deriving support in the newly placed engineered fill. Recommendations for the design of a post-tensioned foundation system are provided in Section 7.9.

7.1.8 Soft alluvium is anticipated to be exposed throughout the excavation bottoms and these soils will likely be very moist to wet and subject to excessive pumping. Operation of rubber tire equipment on these subgrade soils may cause excessive disturbance of the soils, and equipment may sink and become stuck in the soft soils. Excavation activities to establish the finished subgrade elevation must be conducted carefully and methodically to avoid excessive disturbance to the subgrade. Track-mounted equipment should be considered. Stabilization of the bottom of the excavation may be required in order to provide a firm working surface upon which heavy equipment can operate. Recommendations for bottom stabilization and earthwork are provided in the *Grading* section of this report (see Section 7.4).

7.1.9 The upper alluvial soils as encountered during site exploration were very moist and the grading contractor should be aware that the existing soils are currently near or slightly above optimum moisture content. Conditions could change seasonally. If the soils are more than 3 percent above the optimum moisture content at the time of construction the soils will likely require some spreading and drying activities in order to achieve proper compaction.

7.1.10 Soil additives, like lime or cement, can also be considered to reduce the moisture content, reduce the expansion potential, and stabilize the upper soils. Recommendations for soil stabilization through the use of lime or cement can be addressed under separate cover, if desired.

7.1.11 Groundwater was encountered at depths of approximately 16 to 20 feet during the field investigation at the subject site. The depth to groundwater at the time of construction may be different. We expect groundwater would be encountered during the installation of rammed aggregate piers or deep drilled excavations.

7.1.12 It is anticipated that stable excavations for the recommended grading associated with the proposed structures can be achieved with sloping measures. However, if excavations in close proximity to an adjacent property line and/or structure are required, special excavation measures may be necessary in order to maintain lateral support of offsite improvements. Excavation recommendations are provided in the *Temporary Excavations* section of this report (Section 7.20).

7.1.13 At this time, it is unknown if the deeper artificial fill associated with the former USTs will be excavated and recompacted as engineered fill. Based on available information, the artificial fill may extend to depths of up to 29 feet below the ground surface. Temporary excavations to remove this artificial fill will likely require sloping and or shoring measures. Furthermore, the excavation would extend below the groundwater table and temporary dewatering measures may be required. Once the project proceeds to a more finalized state, additional recommendations for deeper temporary excavations can be provided under separate cover.

7.1.14 Where miscellaneous subterranean improvements are planned (Elevator Pits and Swimming Pool), the structures may be supported on a conventional foundation system deriving support in the undisturbed alluvial soils found at and below a depth of 6 feet. If necessary, these miscellaneous improvements may derive support in a combination of newly placed engineered fill and undisturbed alluvium found at and below a depth of 6 feet. Stabilization of the alluvial soils at the excavation bottom may be necessary. It is the intent of the Geotechnical Engineer to allow miscellaneous subterranean structures to derive support in both engineered fill and alluvium if project conditions warrant such an occurrence. Recommendations for swimming pool and elevator pit design are provided in Sections 7.17 and 7.18 of this report, respectively.

7.1.15 Improvements which are not supported on deepened foundations, such as walkways, paving, and utilities, may still be subject to seismic and/or static settlement. Furthermore, the upper portion of existing site soils have a medium expansive potential and could be subject to heave and settlement if the soil is subjected to repeated wetting and drying. The client should consider the flexibility of the products and pavements being installed. It is recommended that all utilities traversing through existing site soils utilize flexible connections in order to minimize the damage to underground installations caused by potential soil movements.

7.1.16 Foundations for small outlying structures, such as block walls less than 6 feet high, planter walls or trash enclosures, which will not be tied to the proposed structure, may be supported on conventional foundations deriving support on a minimum of 12 inches of newly placed engineered fill which extends laterally at least 12 inches beyond the foundation area. Where excavation and proper compaction cannot be performed or is undesirable, foundations may derive support directly in the undisturbed alluvial soils found at or below a depth of 2 feet and should be deepened as necessary to maintain a minimum 12-inch embedment into the recommended bearing materials. If the soils exposed in the excavation bottom are soft or loose, compaction of the soils will be required prior to placing steel or concrete. Compaction of the foundation excavation bottom is typically accomplished with a compaction wheel or mechanical whacker and must be observed and approved in writing by a Geocon representative.

7.1.17 Where new paving is to be placed, it is recommended that all existing fill and soft alluvial soils be excavated and properly compacted for paving support. The client should be aware that excavation and compaction of all existing fill and soft soils in the area of new paving is not required; however, paving constructed over existing uncertified fill or unsuitable alluvium may experience increased settlement and/or cracking, and may therefore have a shorter design life and increased maintenance costs. As a minimum, the upper 12 inches of soil should be scarified and properly compacted for paving support. Paving recommendations are provided in *Preliminary Pavement Recommendations* section of this report (see Section 7.13).

7.1.18 Based on the presence of expansive soils and relatively shallow groundwater at the subject site, infiltration of stormwater is not consider feasible and is not recommended for this development.

7.1.19 Once the design and foundation loading configuration for the proposed structure proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary. Based on the final foundation loading configurations, the potential for settlement should be re-evaluated by this office.

7.1.20 Any changes in the design, location or elevation, as outlined in this report, should be reviewed by this office. Geocon should be contacted to determine the necessity for review and possible revision of this report.

7.2 Soil and Excavation Characteristics

7.2.1 The in-situ soils can be excavated with light to moderate effort using conventional excavation equipment. Moderate caving and slumping should be anticipated in unshored excavations, especially where granular or saturated soil is encountered

7.2.2 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable OSHA rules and regulations to maintain safety and maintain the stability of adjacent existing improvements.

7.2.3 All onsite excavations must be conducted in such a manner that potential surcharges from existing structures, construction equipment, and vehicle loads are resisted. The surcharge area may be defined by a 1:1 projection down and away from the bottom of an existing foundation or vehicle load. Penetrations below this 1:1 projection will require special excavation measures such as sloping and shoring. Temporary excavation recommendations are provided in Section of this report (see Section 7.20).

7.2.4 Based on laboratory test results, the near surface site soils encountered during the field investigation are considered to have a "medium" (expansion index of 90 or less) expansive potential and are classified as "expansive" in accordance with the 2016 California Building Code (CBC) Section 1803.5.3. The recommendations presented herein assume that the building foundations, slabs, and paving will derive support in these materials.

7.3 Minimum Resistivity, pH, and Water-Soluble Sulfate

7.3.1 Potential of Hydrogen (pH) and resistivity testing as well as chloride content testing were performed on representative samples of soil to generally evaluate the corrosion potential to surface utilities. The tests were performed in accordance with California Test Method Nos. 643 and 422 and indicate that the soils are considered "severely corrosive" with respect to corrosion of buried ferrous metals on site. The results are presented in Appendix B (Figure B10) and should be considered for design of underground structures. Due to the corrosive potential of the soils, it is recommended that ABS pipes be considered in lieu of cast-iron for subdrains and retaining wall drains.

7.3.2 Laboratory tests were performed on representative samples of the site materials to measure the percentage of water-soluble sulfate content. Results from the laboratory water-soluble sulfate tests are presented in Appendix B (Figure B10) and indicate that the on-site materials possess a sulfate exposure class of "S0" to concrete structures as defined by 2016 CBC Section 1904 and ACI 318-14 Table 19.3.1.1.

7.3.3 Geocon West, Inc. does not practice in the field of corrosion engineering and mitigation. If corrosion sensitive improvements are planned, it is recommended that a corrosion engineer be retained to evaluate corrosion test results and incorporate the necessary precautions to avoid premature corrosion of buried metal pipes and concrete structures in direct contact with the soils.

7.4 Grading

7.4.1 Earthwork should be observed, and compacted fill tested by representatives of Geocon West, Inc. The existing fill encountered during exploration is suitable for re-use as an engineered fill, provided any encountered oversize material (greater than 6 inches) and any encountered deleterious debris is removed.

7.4.2 A preconstruction conference should be held at the site prior to the beginning of grading operations with the owner, contractor, civil engineer, geotechnical engineer, and building official in attendance. Special soil handling requirements can be discussed at that time.

7.4.3 Grading should commence with the removal of all existing vegetation and existing improvements from the area to be graded. Deleterious debris such as wood and root structures should be exported from the site and should not be mixed with the fill soils. Asphalt and concrete should not be mixed with the fill soils unless approved by the Geotechnical Engineer. All existing underground improvements planned for removal should be completely excavated and the resulting depressions properly backfilled in accordance with the procedures described herein. Once a clean excavation bottom has been established it must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon West, Inc.).

7.4.4 As a minimum, the upper 6 feet of existing soils within the footprint areas of the proposed apartment structures should be excavated and properly compacted for foundation and slab support. The engineered fill blanket should extend at least 3 feet beyond the edge of foundations or for a distance equal to the depth of fill below the foundations, whichever is greater. Proposed foundations should be underlain by at least 4 feet of newly compacted engineered fill. It is recommended that the grading contractor verify the depth of all building foundations prior to commencement of site grading activities in order to correctly determine the required grading overexcavations for foundations. Deeper fill or soft soils encountered during site grading operations should be completely over-excavated as necessary at the direction of the Geotechnical Engineer. The limits of existing fill and/or soft soil removal will be verified by the Geocon representative during site grading operations.

7.4.5 Where supported on ground improvement, it is recommended that the upper 3 feet of existing site soils within the footprint of the proposed structures be excavated and properly compacted for foundation and slab support. The engineered fill blanket should extend at least 3 feet beyond the edge of foundations, including building appurtenances, or for a distance equal to the depth of fill below the foundations, whichever is greater.

7.4.6 All excavations must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon). Prior to placing any fill, the excavation bottom must be proof-rolled with heavy equipment in the presence of the Geotechnical Engineer (a representative of Geocon West, Inc.). If determined to be excessively soft, additional removals or stabilization of the excavation bottom may be required in order to provide a firm working surface upon which engineered fill can be placed and heavy equipment can operate.

7.4.7 If subgrade stabilization is required at the excavation bottom, rubber tire equipment should not be allowed in the excavation bottom until it is stabilized or extensive soil disturbance could result. It is suggested that excavation and grading be performed during the summer season to promote moisture control of the soils. In addition, the use of track equipment should be considered to minimize disturbance to the soils if they become wet at the excavation bottom. Bottom stabilization, if necessary, may be achieved by introducing a thin lift of 3- to 6-inch diameter crushed angular rock into the soft excavation bottom. The use of crushed concrete will also be acceptable. The crushed rock should be spread thinly across the excavation bottom and pressed into the soils by track rolling or wheel rolling with heavy equipment. It is very important that voids between the rock fragments are not created so the rock must be thoroughly pressed or blended into the soils.

7.4.8 The upper alluvial soils at the site are currently very moist and the grading contractor should be aware that the existing soils are currently near or slightly above optimum moisture content. Conditions could change seasonally. If the soils are in excess of 3 percent above optimum moisture content at the time of construction the soils will likely require some spreading and drying activities in order to achieve proper compaction.

7.4.9 All fill and backfill soils should be placed in horizontal loose layers approximately 6 to 8 inches thick, moisture conditioned to 2 percent above optimum moisture content, and properly compacted to a minimum 90 percent of the maximum dry density in accordance with ASTM D 1557 (latest edition).

7.4.10 It is anticipated that stable excavations for the recommended grading can be achieved with sloping measures. However, if excavations in close proximity to an adjacent property line and/or structure are required, special excavation measures may be necessary in order to maintain lateral support of the existing offsite improvements. Excavation recommendations are provided in the *Temporary Excavations* section of this report (Section 7.20).

7.4.11. Where new paving is to be placed, it is recommended that all existing fill and soft alluvium be excavated and properly compacted for paving support. As a minimum, the upper 12 inches of soil should be scarified, moisture conditioned to optimum moisture content, and compacted to at least 92 percent relative compaction, as determined by ASTM Test Method D 1557 (latest edition). Paving recommendations are provided in *Preliminary Pavement Recommendations* section of this report (see Section 7.13).

7.4.12 Foundations for small outlying structures, such as block walls less than 6 feet high, planter walls or trash enclosures, which will not be tied to the proposed building, may be supported on conventional foundations deriving support on a minimum of 12 inches of newly placed engineered fill which extends laterally at least 12 inches beyond the foundation area. Where excavation and proper compaction cannot be performed or is undesirable, foundations may derive support directly in the undisturbed alluvial soils found at or below a depth of 2 feet, and should be deepened as necessary to maintain a minimum 12 inch embedment into the recommended bearing materials. If the soils exposed in the excavation bottom are soft or loose, compaction of the soils will be required prior to placing steel or concrete. Compaction of the foundation excavation bottom is typically accomplished with a compaction wheel or mechanical whacker and must be observed and approved by a Geocon representative.

7.4.13 It is recommended that flexible utility connections be utilized for all rigid utilities to minimize or prevent damage to utilities from minor differential soil movements and subsidence. Utility trenches should be properly backfilled in accordance with the requirements of the Green Book (latest edition). The pipe should be bedded with clean sands (Sand Equivalent greater than 30) to a depth of at least 1 foot over the pipe, and the bedding material must be inspected and approved in writing by the Geotechnical Engineer (a representative of Geocon). The use of gravel is not acceptable unless used in conjunction with filter fabric to prevent the gravel from having direct contact with soil. The remainder of the trench backfill may be derived from onsite soil or approved import soil, compacted as necessary, until the required compaction is obtained. The use of minimum 2-sack slurry is also acceptable as backfill. Prior to placing any bedding materials or pipes, the excavation bottom must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon).

7.4.14 Although not anticipated for this project, all imported fill shall be observed, tested, and approved by Geocon West, Inc. prior to bringing soil to the site. Rocks larger than 6 inches in diameter shall not be used in the fill. If necessary, import soils used as structural fill should have an expansion index less than 50 and soil corrosivity properties that are equally or less detrimental to that of the existing onsite soils (see Figure B10).

7.4.15 All trench and foundation excavation bottoms must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon), prior to placing bedding materials, fill, steel, gravel or concrete.

7.5 Shrinkage

7.5.1 Shrinkage results when a volume of material removed at one density is compacted to a higher density. A shrinkage factor of up to 10 percent should be anticipated when excavating and compacting the upper 5 feet of existing earth materials on the site to an average relative compaction of 92 percent.

7.4.2 If import soils will be utilized in the building pad, the soils must be placed uniformly and at equal thickness at the direction of the Geotechnical Engineer (a representative of Geocon West, Inc.). Soils can be borrowed from non-building pad areas and later replaced with imported soils.

7.6 Foundation Design – General

7.6.1 Due to the expansive nature of the on-site soils, the moisture content of untreated subgrade soils should be maintained at 2 to 3 percent above optimum moisture content prior to and at the time of concrete placement. If the subgrade is allowed to dry out, presaturation and/or moisture conditioning and recompacting will be required.

7.6.2 Foundation excavations should be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon West, Inc.), prior to the placement of reinforcing steel and concrete to verify that the excavations and exposed soil conditions are consistent with those anticipated. If unanticipated soil conditions are encountered, foundation modifications may be required.

7.6.3 Where side by side construction is planned for the residential structure and parking structure it is recommended that the parking structure be constructed prior to the adjacent residential structure in order to allow the majority of the static settlement to occur in the parking structure. This will help to minimize differential settlements between the two structures. It is recommended that either a seismic separation or flexible connection be utilized where the apartment structures and parking structure may be attached. The design of the connection is at the discretion of the project structural engineer. Additional settlement analyses should be performed once the foundation loading configuration for the proposed structures is established to further evaluate the potential for differential settlement between the residential structure and parking structure. The utilization of a lesser bearing value, or increasing the thickness of engineered fill below the foundations, would further reduce the anticipated settlements and could be evaluated once the design becomes more finalized.

7.6.4 It is recommended that a seismic separation or flexible connection be utilized where the adjacent structures abut. The design of the connection is at the discretion of the project structural engineer and should take into account potential differential settlements between structures.

7.6.5 It is recommended that flexible utility connections be utilized for all rigid utilities to minimize or prevent damage to utilities from minor differential movements.

7.6.6 This office should be provided a copy of the final construction plans so that the excavation recommendations presented herein could be properly reviewed and revised if necessary.

7.6.7 Once the design and foundation loading configurations for the proposed structures proceeds to a more finalized plan, the estimated settlements presented in this report should be reviewed and revised, if necessary. If the final foundation loading configurations are greater than the assumed loading conditions, the potential for settlement should be reevaluated by this office.

7.7 Rammed Aggregate Piers (RAP)

7.7.1 Due to the compressible alluvial soils, it is recommended that soil improvement (e.g. Rammed Aggregate Piers) be considered below the proposed parking structure. Subsequent to construction of the Rammed Aggregate Pier (RAP), the proposed parking structure may be supported on a conventional foundation system deriving support in the improved soils. The foundation should be designed to derive vertical support from the RAP improved soils and may develop lateral resistance at the foundation perimeter, as well as by friction beneath the foundations, if necessary.

7.7.2 The RAP system is based on soil improvement that consists of installing densified, aggregate columns to depths typically ranging up to about 25 feet below the proposed foundation elevation. The system increases density and lateral stress in the surrounding soil and claims improvement in bearing capacity and settlement potential. RAP elements are constructed by creating shafts (commonly 30 inches in diameter) by drilling or displacement methods, and backfilling the open shaft with specially rammed/compacted, open graded crushed rock and Class 2 AB in 10- to 12-inch lifts. It should be noted that creating the shaft using the displacement method, advancing the shaft with a displacement mandrel, reduces the soil cuttings generated during the creation of the shaft.

7.7.3 The pattern and depth of ground improvements may vary depending upon the purposes of mitigation and stratigraphic conditions. The contractor should design the RAP to incorporate allowable static and seismic settlements in accordance with the recommendations of the project structural engineer. The RAP contractor should evaluate the post-installation static and dynamic settlement within the remediation zone of the RAP. In addition, the project structural engineer should evaluate if the planned structures can tolerate the planned settlements after the installation of the RAP.

7.7.4 Spacing and diameter should be selected by the specialty contractor to obtain the necessary remediation as outlined herein. The RAP mitigation should extend at least 15 feet laterally outside the edge of planned building structures, where practical.

7.7.5 RAP design should be based on settlement criterial of a maximum combined static and seismic differential settlement of 1 inch between adjacent columns. The anticipated seismic induced differential settlement should be evaluated once the depth of the RAP ground improvement is established, as the ground improvement may mitigate some of the potentially liquefiable soil layers.

7.7.6 The RAP design package should be submitted to Geocon West, Inc. for review at least two weeks prior to mobilization for construction. Within the design package, the specialty contractor should outline a performance and load testing program to verify the effectiveness of the ground improvement and to confirm the bearing capacity of the improved soils with a full-scale load test. During the load testing, a representative of Geocon should be present to observe RAP installation and testing. The information obtained from the load testing should be used to modify the depth necessary to achieve design capacities, as well as develop installation criteria that can be used during construction.

7.8 Conventional Foundation Design – Parking Structure

7.8.1 The proposed parking structure may be supported on a conventional spread foundation system deriving support on the RAP ground improvement. All foundation excavations must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon), prior to placing steel or concrete.

7.8.2 Continuous footings should be a minimum of 12 inches in width, 24 inches in depth below the lowest adjacent grade, and 12 inches into the recommended bearing material. Isolated spread foundations should be a minimum of 24 inches in width, 24inches in depth below the lowest adjacent grade, and 12 inches into the recommended bearing material. Foundations constructed over RAP ground improvement can achieve relatively high bearing pressures. For preliminary design purposes, a bearing pressure of 6,000 psf may be assumed; however, the design bearing pressure should be provided by the RAP contractor.

7.8.3 The allowable bearing pressures may be increased by one-third for transient loads due to wind or seismic forces.

7.8.4 For preliminary design purposes, a modulus of subgrade reaction of 150 pounds per cubic inch (pci) may be utilized for design of the mat foundations where directly underlain by compacted fill. However, the RAP contractor should provide the structural engineer a revised modulus value incorporating the planned improvement techniques. Additionally, where a higher subgrade modulus is required beneath the foundation system, the site soils can be stabilized using lime or cement, or can be replaced with a more granular imported soil. This value is a unit value for use with a 1-foot square footing. The modulus should be reduced in accordance with the following equation when used with larger foundations:

$$K_R = K\left[\frac{B+1}{2B}\right]^2$$

where: K_R = reduced subgrade modulus
K = unit subgrade modulus
B = foundation width (in feet)

7.8.5 If depth increases are utilized for the exterior wall footings, this office should be provided a copy of the final construction plans so that the excavation recommendations presented herein could be properly reviewed and revised if necessary.

7.8.6 Continuous footings should be reinforced with four No. 4 steel reinforcing bars, two placed near the top of the footing and two near the bottom. Reinforcement for spread footings should be designed by the project structural engineer.

7.8.7 The above foundation dimensions and minimum reinforcement recommendations are based on soil conditions and building code requirements only, and are not intended to be used in lieu of those required for structural purposes.

7.8.8 Due to the expansive nature of the on-site soils, the moisture content of untreated subgrade soils should be maintained at 2 to 5 percent above optimum moisture content prior to and at the time of concrete placement. If the subgrade is allowed to dry out, presaturation and/or moisture conditioning and recompacting will be required.

7.8.9 Foundation excavations should be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon West, Inc.), prior to the placement of reinforcing steel and concrete to verify that the excavations and exposed soil conditions are consistent with those anticipated. If unanticipated soil conditions are encountered, foundation modifications may be required.

7.8.10 This office should be provided a copy of the final construction plans so that the excavation recommendations presented herein could be properly reviewed and revised if necessary.

7.9 Post-Tensioned Foundation Recommendations

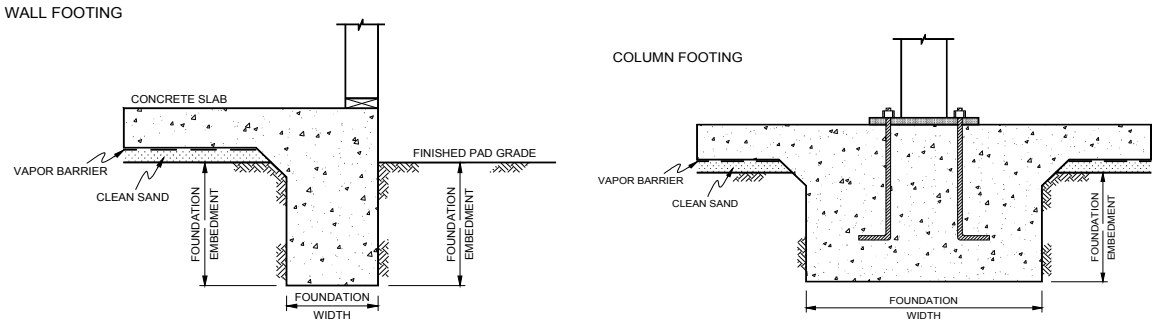
7.9.1 Subsequent to the recommended grading, it is recommended that a post-tensioned foundation system be utilized for support of the proposed apartment buildings. Proposed post-tensioned foundations should be underlain by at least 4 feet of newly placed engineered fill. Additional grading should be conducted as necessary in order to maintain the required 4-foot-thick blanket of engineered fill below foundations.

7.9.2 The post-tensioned system should be designed by a structural engineer experienced in post-tensioned slab design and design criteria of the Post-Tensioning Institute (PTI) DC 10.5-12 *Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundations on Expansive Soils* or *WRI/CRSI Design of Slab-on-Ground Foundations*, as required by the 2016 California Building Code (CBC Section 1808.6.2). Although this procedure was developed for expansive soil conditions, we understand it can also be used to reduce the potential for foundation distress due to differential settlement. The post-tensioned design should incorporate the geotechnical parameters presented in the following table, which are based on the guidelines presented in the PTI, Third Edition design manual. The parameters presented below are based on a medium expansive potential ($50<EI\underline{\leq}90$), as well as the potential for and magnitude of anticipated seismically induced settlements.

POST-TENSIONED FOUNDATION SYSTEM DESIGN PARAMETERS

Post-Tensioning Institute (PTI) DC 10.5-12 Design Parameters	Value
Thornthwaite Index	-20
Equilibrium Suction	3.9
Edge Lift Moisture Variation Distance, e_M (Feet)	5.1
Edge Lift, y_M (Inches)	1.10
Center Lift Moisture Variation Distance, e_M (Feet)	9.0
Center Lift, y_M (Inches)	0.47

7.9.3 The foundations for the post-tensioned slabs should be embedded in accordance with the recommendations of the structural engineer. If a post-tensioned mat foundation system is proposed, the slab should possess a thickened edge with a minimum width of 12 inches and extend below the clean sand or crushed rock layer. A graphic depicting the foundation embedment is provided below.



7.9.4 If the structural engineer proposes a post-tensioned foundation design method other than PTI DC 10.5:

- The criteria presented in the above table are still applicable.
- Interior stiffener beams should be used.
- The width of the perimeter foundations should be at least 12 inches.
- The perimeter footing embedment depths should be at least 24 inches. The embedment depths should be measured from the lowest adjacent pad grade.

7.9.5 During the construction of the post-tension foundation system, the concrete should be placed monolithically. Under no circumstances should cold joints form between the footings/grade beams and the slab during the construction of the post-tension foundation system unless specifically designed by the structural engineer.

7.9.6 Post-tensioned foundations for support of the apartment structures may be designed for an allowable soil bearing pressure of 2,500 psf (dead plus live load). This bearing pressure may be increased by one-third for transient loads due to wind or seismic forces. We estimate the total static settlements under the imposed allowable loads to be about ⅔ inch with differential settlements on the order of ½ inch over a horizontal distance of 20 feet. A majority of the settlement of the foundation system is expected to occur on initial application of loading; however, additional settlements are expected within the first twelve months. Based on seismic considerations, the proposed structures supported on should be designed for a combined static and seismically induced differential settlement of 1 inch over a distance of 20 feet.

7.9.7 Isolated footings, if present, should have a minimum embedment depth and width of 24 inches. The use of isolated footings, which are located beyond the perimeter of the building and support structural elements connected to the building, are not recommended. If this condition cannot be avoided, the isolated footings should be connected to the building foundation system with grade beams. In addition, consideration should be given to connecting patio slabs, which exceed 5 feet in width, to the building foundation to reduce the potential for future separation to occur.

7.9.8 Due to the expansive potential of the subgrade soils, the moisture content in the slab and foundation subgrade should be maintained between 2 and 3 percent above optimum moisture content prior to and at the time of concrete placement.

7.9.9 The recommendations of this report are intended to reduce the potential for cracking of slabs and foundations due to expansive soil (if present), differential settlement of fill soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

7.9.10 Interior stiffening beams should be incorporated into the design of the foundation system in accordance with the PTI design procedures.

7.9.11 Foundation excavations should be observed by the Geotechnical Engineer (a representative of Geocon West, Inc.) prior to the placement of reinforcing steel and concrete to check that the exposed soil conditions are consistent with those expected and have been extended to appropriate bearing strata. If unexpected soil conditions are encountered, foundation modifications may be required.

7.9.12 Our experience indicates post-tensioned slabs may be susceptible to excessive edge lift, regardless of the underlying soil conditions. Placing reinforcing steel at the bottom of the perimeter footings and the interior stiffener beams may mitigate this potential. The structural engineer should design the foundation system to reduce the potential of edge lift occurring for the proposed structures.

7.9.13 During the construction of the post-tension foundation system, the concrete should be placed monolithically. Under no circumstances should cold joints form between the footings/grade beams and the slab during the construction of the post-tension foundation system unless designed by the structural engineer.

7.9.14 Geocon should observe the foundation excavations prior to the placement of reinforcing steel to check that the exposed soil conditions are similar to those expected and that they have been extended to the appropriate bearing strata. If unexpected soil conditions are encountered, foundation modifications may be required.

7.10 Lateral Design

7.10.1 Resistance to lateral loading may be provided by friction acting at the base of foundations, slabs and by passive earth pressure. An allowable coefficient of friction of 0.25 may be used with the dead load forces in the competent alluvial soils or in properly compacted engineered fill.

7.10.2 Passive earth pressure for the sides of foundations and slabs poured against properly compacted engineered fill or competent alluvial soils may be computed as an equivalent fluid having a density of 200 pcf with a maximum earth pressure of 2,000 psf. When combining passive and friction for lateral resistance, the passive component should be reduced by one-third.

7.11 Miscellaneous Foundations

7.11.1 Foundations for small outlying structures, such as block walls up to 6 feet in height, planter walls or trash enclosures, which will not be structurally supported by the proposed building, may be supported on conventional foundations deriving support on a minimum of 12 inches of newly placed engineered fill which extends laterally at least 12 inches beyond the foundation area. Where excavation and compaction cannot be performed, such as adjacent to property lines, foundations may derive support in the undisturbed alluvial soils found at or below a depth of 2 feet, and should be deepened as necessary to maintain a minimum 12-inch embedment into the recommended bearing materials.

7.11.2 If the soils exposed in the excavation bottom are soft, compaction of the soft soils will be required prior to placing steel or concrete. Compaction of the foundation excavation bottom is typically accomplished with a compaction wheel or mechanical whacker and must be observed and approved by a Geocon representative. Miscellaneous foundations may be designed for a bearing value of 1,500 psf, and should be a minimum of 12 inches in width, 18 inches in depth below the lowest adjacent grade and 12 inches into the recommended bearing material. The allowable bearing pressure may be increased by up to one-third for transient loads due to wind or seismic forces.

7.11.3 Foundation excavations should be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon West, Inc.), prior to the placement of reinforcing steel and concrete to verify that the excavations and exposed soil conditions are consistent with those anticipated.

7.12 Concrete Slabs-on-Grade

7.12.1 Where supported on a conventional foundation system underlain by RAP ground improvement, concrete slabs-on-grade for structures subject to vehicle loading should be a minimum 5 inches of concrete reinforced with No. 4 steel reinforcing bars placed 16 inches on center in both horizontal directions. Steel reinforcing should be positioned vertically near the slab midpoint. The slab-on-grade may derive support in the newly placed engineered fill.

7.12.2 Slabs-on-grade at the ground surface that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder placed directly beneath the slab. The vapor retarder and acceptable permeance should be specified by the project architect or developer based on the type of floor covering that will be installed. The vapor retarder design should be consistent with the guidelines presented in Section 9.3 of the American Concrete Institute's (ACI) *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials* (ACI 302.2R-06) and should be installed in general conformance with ASTM E 1643 (latest edition) and the manufacturer's recommendations. A minimum thickness of 15 mils extruded polyolefin plastic is recommended; vapor retarders which contain recycled content or woven materials are not recommended. The vapor retarder should have a permeance of less than 0.01 perms demonstrated by testing before and after mandatory conditioning. The vapor retarder should be installed in direct contact with the concrete slab with proper perimeter seal. If the California Green Building Code requirements apply to this project, the vapor retarder should be underlain by 4 inches of clean aggregate. It is important that the vapor retarder be puncture resistant since it will be in direct contact with angular gravel. As an alternative to the clean aggregate suggested in the California Green Building Code, it is our opinion that the concrete slab-on-grade may be underlain by a vapor retarder over 4 inches of clean sand (sand equivalent greater than 30), since the sand will serve a capillary break and will minimize the potential for punctures and damage to the vapor barrier.

7.12.3 For seismic design purposes, a coefficient of friction of 0.25 may be utilized between concrete slabs and subgrade soils without a moisture barrier, and 0.15 for slabs underlain by a moisture barrier.

7.12.4 Exterior slabs, not subject to traffic loads, should be at least 4 inches thick and reinforced with No. 3 steel reinforcing bars placed 18 inches on center in both horizontal directions, positioned near the slab midpoint. Prior to construction of slabs, the upper 12 inches of subgrade should be moistened to near optimum moisture content and properly compacted to at least 92 percent relative compaction, as determined by ASTM Test Method D 1557 (latest edition). Crack control joints should be spaced at intervals not greater than 10 feet and should be constructed using saw-cuts or other methods as soon as practical following concrete placement. Crack control joints should extend a minimum depth of one-fourth the slab thickness. The project structural engineer should design construction joints as necessary.

8.12.6 Due to the expansive potential of the anticipated subgrade soils, the moisture content of the slab subgrade should be maintained and sprinkled as necessary to maintain a moist condition as would be expected in any concrete placement. Furthermore, consideration should be given to doweling slabs into adjacent curbs and foundations to minimize movements and offsets which could lead to a potential tripping hazard. As an alternative, the upper 18 inches of soil could be replaced with granular, non-expansive soils which will reduce the potential for movements and offsets.

7.12.5 The recommendations of this report are intended to reduce the potential for cracking of slabs due to settlement. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade may exhibit some cracking due to minor soil movement and/or concrete shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

7.13 Preliminary Pavement Recommendations

7.13.1 Where new paving is to be placed, it is recommended that all existing fill and soft or unsuitable soils be excavated and properly compacted for paving support. The client should be aware that excavation and compaction of all soft or unsuitable soils in the area of new paving is not required, however, paving constructed over existing unsuitable soils may experience increased settlement and/or cracking, and may therefore have a shorter design life and increased maintenance costs. As a minimum, the upper 12 inches of soil should be scarified and recompacted to at least 92 percent relative compaction, as determined by ASTM Test Method D 1557 (latest edition).

7.13.2 The following pavement sections are based on an assumed R-Value of 10. Once site grading activities are complete an R-Value should be obtained by laboratory testing to confirm the properties of the soils serving as paving subgrade, prior to placing pavement.

7.13.3 The Traffic Indices listed below are estimates. Geocon does not practice in the field of traffic engineering. The actual Traffic Index for each area should be determined by the project civil engineer. If pavement sections for Traffic Indices other than those listed below are required, Geocon should be contacted to provide additional recommendations. Pavement thicknesses were determined following procedures outlined in the *California Highway Design Manual* (Caltrans). It is anticipated that the majority of traffic will consist of automobile and large truck traffic.

PRELIMINARY PAVEMENT DESIGN SECTIONS

Location	Estimated Traffic Index (TI)	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
Automobile Parking And Driveways	5.0	3.0	9.0
Trash Truck & Fire Lanes	7.0	4.0	14.5

7.13.4 Asphalt concrete should conform to Section 203-6 of the "*Standard Specifications for Public Works Construction"* (Green Book). Class 2 aggregate base materials should conform to Section 26-1.02A of the "*Standard Specifications of the State of California, Department of Transportation"* (Caltrans). Crushed Miscellaneous Base should conform to Section 200-2.4 of the "*Standard Specifications for Public Works Construction"* (Green Book).

7.13.5 Unless specifically designed and evaluated by the project structural engineer, where concrete paving will be utilized for support of vehicles, we recommend that the concrete be a minimum of 6 inches thick and reinforced with No. 3 steel reinforcing bars placed 18 inches on center in both horizontal directions. Concrete paving supporting vehicular traffic should be underlain by a minimum of 4 inches of aggregate base and a properly compacted subgrade. The subgrade and base material should be compacted to at least 92 percent and 95 percent relative compaction, respectively, as determined by ASTM Test Method D 1557 (latest edition).

7.13.6 The performance of pavements is highly dependent upon providing positive surface drainage away from the edge of pavements. Ponding of water on or adjacent to the pavement will likely result in saturation of the subgrade materials and subsequent cracking, subsidence and pavement distress. If planters are planned adjacent to paving, it is recommended that the perimeter curb be extended at least 12 inches below the bottom of the aggregate base to minimize the introduction of water beneath the paving.

7.14 Retaining Wall Design

7.14.1 The recommendations presented below are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 8 feet. In the event that walls significantly higher than 8 feet are planned, Geocon should be contacted for additional recommendations.

7.14.2 Retaining walls with a level backfill surface that are not restrained at the top should be designed utilizing a triangular distribution of pressure (active pressure) of 40 pcf.

7.14.3 Restrained walls are those that are not allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall in feet) at the top of the wall. Where walls are restrained from movement at the top, walls may be designed utilizing a triangular distribution of pressure (at-rest pressure) of 60 pcf.

7.14.4 The wall pressures provided above assume that the retaining wall will be properly drained preventing the buildup of hydrostatic pressure. If retaining wall drainage is not implemented, the equivalent fluid pressure to be used in design of undrained walls is 80 pcf. The value includes hydrostatic pressures plus buoyant lateral earth pressures.

7.14.5 The wall pressures provided above assume that the proposed retaining walls will support either relatively undisturbed alluvial soils or engineered fill derived from onsite soils. If import soils are used as wall backfill, revised earth pressures may be required to account for the characteristics of the import soil.

7.14.6 Additional active pressure should be added for a surcharge condition due to sloping ground, vehicular traffic or adjacent structures and should be designed for each condition as the project progresses. Recommendations for the incorporation of surcharges are provided in section 7.21 of this report.

7.14.7 In addition to the recommended earth pressure, the upper 10 feet of the subterranean wall adjacent to the street or driveway areas should be designed to resist a uniform lateral pressure of 100 psf, acting as a result of an assumed 300 psf surcharge behind the wall due to normal street traffic. If the traffic is kept back at least 10 feet from the subterranean walls, the traffic surcharge may be neglected.

7.14.8 Seismic lateral forces should be incorporated into the design as necessary, and recommendations for seismic lateral forces are presented below.

7.15 Dynamic (Seismic) Lateral Forces

7.15.1 The structural engineer should determine the seismic design category for the project in accordance with Section 1613 of the CBC. If the project possesses a seismic design category of D, E, or F, proposed retaining walls in excess of 6 feet in height should be designed with seismic lateral pressure (Section 1803.5.12 of the 2016 CBC).

7.15.2 A seismic load of 10 pcf should be used for design of walls that support more than 6 feet of backfill in accordance with Section 1803.5.12 of the 2016 CBC. The seismic load is applied as an equivalent fluid pressure along the height of the wall and the calculated loads result in a maximum load exerted at the base of the wall and zero at the top of the wall. This seismic load should be applied in addition to the active earth pressure. The earth pressure is based on half of two thirds of PGA_M calculated from ASCE 7-10 Section 11.8.3.

7.16 Retaining Wall Drainage

7.16.1 Retaining walls should be provided with a drainage system extended at least two-thirds the height of the wall. At the base of the drain system, a subdrain covered with a minimum of 12 inches of gravel should be installed, and a compacted fill blanket or other seal placed at the surface (see Figure 11). The clean bottom and subdrain pipe, behind a retaining wall, should be observed by the Geotechnical Engineer (a representative of Geocon), prior to placement of gravel or compacting backfill.

7.16.2 As an alternative, a plastic drainage composite such as Miradrain or equivalent may be installed in continuous, 4-foot wide columns along the entire back face of the wall, at 8 feet on center. The top of these drainage composite columns should terminate approximately 18 inches below the ground surface, where either hardscape or a minimum of 18 inches of relatively cohesive material should be placed as a cap (see Figure 12). These vertical columns of drainage material would then be connected at the bottom of the wall to a collection panel or a 1-cubic-foot rock pocket drained by a 4-inch subdrain pipe.

7.16.3 Subdrainage pipes at the base of the retaining wall drainage system should outlet to an acceptable location via controlled drainage structures.

7.16.4 Moisture affecting below grade walls is one of the most common post-construction complaints. Poorly applied or omitted waterproofing can lead to efflorescence or standing water. Particular care should be taken in the design and installation of waterproofing to avoid moisture problems, or actual water seepage into the structure through any normal shrinkage cracks which may develop in the concrete walls, floor slab, foundations and/or construction joints. The design and inspection of the waterproofing is not the responsibility of the geotechnical engineer. A waterproofing consultant should be retained in order to recommend a product or method, which would provide protection to subterranean walls, floor slabs and foundations.

7.17 Swimming Pool

7.17.1 The proposed swimming pools should be designed as free-standing structures deriving support in newly placed engineered fill and/or the competent alluvial soils found at or below a depth of 6 feet. Swimming pool walls may be designed in accordance with the *Retaining Wall Design* section of this report (see Section 7.14). The proposed pools should be constructed utilizing an expansive soils design and a hydrostatic relief valve should be considered as part of the swimming pool design unless a gravity drain system can be placed beneath the pool shell.

7.17.2 If a spa is proposed it should be constructed independent of the swimming pool and must not be cantilevered from the swimming pool shell.

7.18 Elevator Pit Design

7.18.1 The elevator pit slab and retaining wall should be designed by the project structural engineer. As a minimum the slab-on-grade for the elevator pit bottom should be at least 4 inches thick and reinforced with No. 3 steel reinforcing bars placed 18 inches on center in both horizontal directions, positioned near the slab midpoint. Elevator pit walls may be designed in accordance with the recommendations in the *Retaining Wall Design* section of this report (see Section 7.14).

7.18.2 Additional active pressure should be added for a surcharge condition due to sloping ground, vehicular traffic or adjacent foundations and should be designed for each condition as the project progresses.

7.18.3 If retaining wall drainage is to be provided, the drainage system should be designed in accordance with the *Retaining Wall Drainage* section of this report (see Section 7.16).

7.18.4 It is suggested that the exterior walls and slab be waterproofed to prevent excessive moisture inside of the elevator pit. Waterproofing design and installation is not the responsibility of the geotechnical engineer.

7.19 Elevator Piston

7.19.1 If a plunger-type elevator piston is installed for this project, a deep drilled excavation will be required. It is important to verify that the drilled excavation is not situated immediately adjacent to a foundation or shoring pile, or the drilled excavation could compromise the existing foundation or pile support, especially if the drilling is performed subsequent to the foundation or pile construction.

7.19.2 Casing may be required if caving is encountered in the drilled excavation. The contractor should be prepared to use casing and should have it readily available at the commencement of drilling activities. The contractor should also be prepared to mitigate buoyant forces during installation of the piston casing. Continuous observation of the drilling and installation of the elevator piston by the Geotechnical Engineer (a representative of Geocon West, Inc.) is required.

7.19.3 The annular space between the piston casing and drilled excavation wall should be filled with a minimum of 1½-sack slurry pumped from the bottom up. As an alternative, pea gravel may be utilized. The use of soil to backfill the annular space is not acceptable.

7.20 Temporary Excavations

7.20.1 Excavations on the order of 6 feet in height are generally anticipated during grading operations. Deeper excavations may be required in the northeast corner of the site. The excavations are expected to expose artificial fill and alluvial soils, which may be subject to caving where granular or saturated soils are exposed. Vertical excavations up to 5 feet in height may be attempted where not surcharged by adjacent traffic or structures.

7.20.2 Vertical excavations greater than 5 feet or where surcharged by existing structures will require sloping or shoring measures in order to provide a stable excavation. Where sufficient space is available, temporary unsurcharged embankments could be sloped back at a uniform 1:1 slope gradient or flatter up to maximum height of 15 feet. A uniform slope does not have a vertical portion.

7.20.3 If excavations in close proximity to an adjacent property line and/or structure are required, special excavation measures such as slot-cutting or shoring may be necessary in order to maintain lateral support of offsite improvements. Recommendations for special temporary excavation measures can be provided under separate cover once the proposed building layout is established.

7.20.4 Where temporary slopes are utilized, the top of the slope should be barricaded to prevent vehicles and storage loads at the top of the slope within a horizontal distance equal to the height of the slope. If the temporary construction slopes are to be maintained during the rainy season, berms are suggested along the tops of the slopes where necessary to prevent runoff water from entering the excavation and eroding the slope faces. The soils exposed in the slopes should be inspected during excavation by our personnel so that modifications of the slopes can be made if variations in the soil conditions occur. All excavations should be stabilized within 30 days of initial excavation.

7.21 Surcharge from Adjacent Structures and Improvements

7.21.1 Additional active pressure should be added for a surcharge condition due to sloping ground, vehicular traffic or adjacent structures and should be designed for each condition as the project progresses.

7.21.2 It is recommended that line-load surcharges from adjacent wall footings, use horizontal pressures generated from NAV-FAC DM 7.2. The governing equations are:

$$For\ {}^{x}/_{H} \leq 0.4$$

$$\sigma_H(z) = \frac{0.20 \times \left(\frac{z}{H}\right)}{\left[0.16 + \left(\frac{z}{H}\right)^2\right]^2} \times \frac{Q_L}{H}$$

and

$$For\ {}^{x}/_{H} > 0.4$$

$$\sigma_H(z) = \frac{1.28 \times \left(\frac{x}{H}\right)^2 \times \left(\frac{z}{H}\right)}{\left[\left(\frac{x}{H}\right)^2 + \left(\frac{z}{H}\right)^2\right]^2} \times \frac{Q_L}{H}$$

where x is the distance from the face of the excavation or wall to the vertical line-load, H is the distance from the bottom of the footing to the bottom of excavation or wall, z is the depth at which the horizontal pressure is desired, Q_L is the vertical line-load and $\sigma_H(z)$ is the horizontal pressure at depth z.

7.21.3 It is recommended that vertical point-loads, from construction equipment outriggers or adjacent building columns use horizontal pressures generated from NAV-FAC DM 7.2. The governing equations are:

$$For\ {}^{x}/_{H} \leq 0.4$$

$$\sigma_H(z) = \frac{0.28 \times \left(\frac{z}{H}\right)^2}{\left[0.16 + \left(\frac{z}{H}\right)^2\right]^3} \times \frac{Q_P}{H^2}$$

and

$$For\ {}^{x}/_{H} > 0.4$$

$$\sigma_H(z) = \frac{1.77 \times \left(\frac{x}{H}\right)^2 \times \left(\frac{z}{H}\right)^2}{\left[\left(\frac{x}{H}\right)^2 + \left(\frac{z}{H}\right)^2\right]^3} \times \frac{Q_P}{H^2}$$

then

$$\sigma'_H(z) = \sigma_H(z) cos^2(1.1\theta)$$

where x is the distance from the face of the excavation/wall to the vertical point-load, H is distance from the outrigger/bottom of column footing to the bottom of excavation, z is the depth at which the horizontal pressure is desired, Q_P is the vertical point-load, $\sigma_H(z)$ is the horizontal pressure at depth z, θ is the angle between a line perpendicular to the excavation/wall and a line from the point-load to location on the excavation/wall where the surcharge is being evaluated, and $\sigma_H(z)$ is the horizontal pressure at depth z.

7.22 Surface Drainage

7.22.1 Proper surface drainage is critical to the future performance of the project. Uncontrolled infiltration of irrigation excess and storm runoff into the soils can adversely affect the performance of the planned improvements. Saturation of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change in the original designed engineering properties. Proper drainage should be maintained at all times.

7.22.2 Site drainage should be collected and controlled in non-erosive drainage devices. Drainage should not be allowed to pond anywhere on the site, and especially not against any foundation or retaining wall. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2016 CBC 1804.4 or other applicable standards. In addition, drainage should not be allowed to flow uncontrolled over any descending slope. Discharge from downspouts, roof drains and scuppers are not recommended onto unprotected soils within 5 feet of the building perimeter. Planters which are located adjacent to foundations should be sealed to prevent moisture intrusion into the soils providing foundation support. Landscape irrigation is not recommended within 5 feet of the building perimeter footings except when enclosed in protected planters.

7.22.3 Positive site drainage should be provided away from structures, pavement, and the tops of slopes to swales or other controlled drainage structures. The building pads and pavement areas should be fine graded such that water is not allowed to pond.

7.22.4 Landscaping planters immediately adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. Either a subdrain, which collects excess irrigation water and transmits it to drainage structures, or an impervious above-grade planter boxes should be used. In addition, where landscaping is planned adjacent to the pavement, it is recommended that consideration be given to providing a cutoff wall along the edge of the pavement that extends at least 12 inches below the base material.

7.23 Plan Review

7.23.1 Grading, foundation, and shoring plans should be reviewed by the Geotechnical Engineer (a representative of Geocon West, Inc.), prior to finalization to verify that the plans have been prepared in substantial conformance with the recommendations of this report and to provide additional analyses or recommendations.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon West, Inc. should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon West, Inc.

2. This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

3. The findings of this report are valid as of the date of this report. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

4. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

LIST OF REFERENCES

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GEOCON WEST, INC.

ENVIRONMENTAL GEOTECHNICAL MATERIALS
15520 ROCKFIELD BOULEVARD, SUITE J, IRVINE, CA 92618
PHONE (949) 491-6570

DRAFTED BY: JA	CHECKED BY: JTA

VICINITY MAP

VICTORIA BOULEVARD APARTMENTS
26126 VICTORIA BOULEVARD
DANA POINT, CALIFORNIA

MARCH 2019	PROJECT NO. A9942-88-01	FIG. 1

LEGEND

B5 — Approximate Location of Boring

CPT5 — Approximate Location of CPT

N

0 80' 160'

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PHONE (949) 491-6570

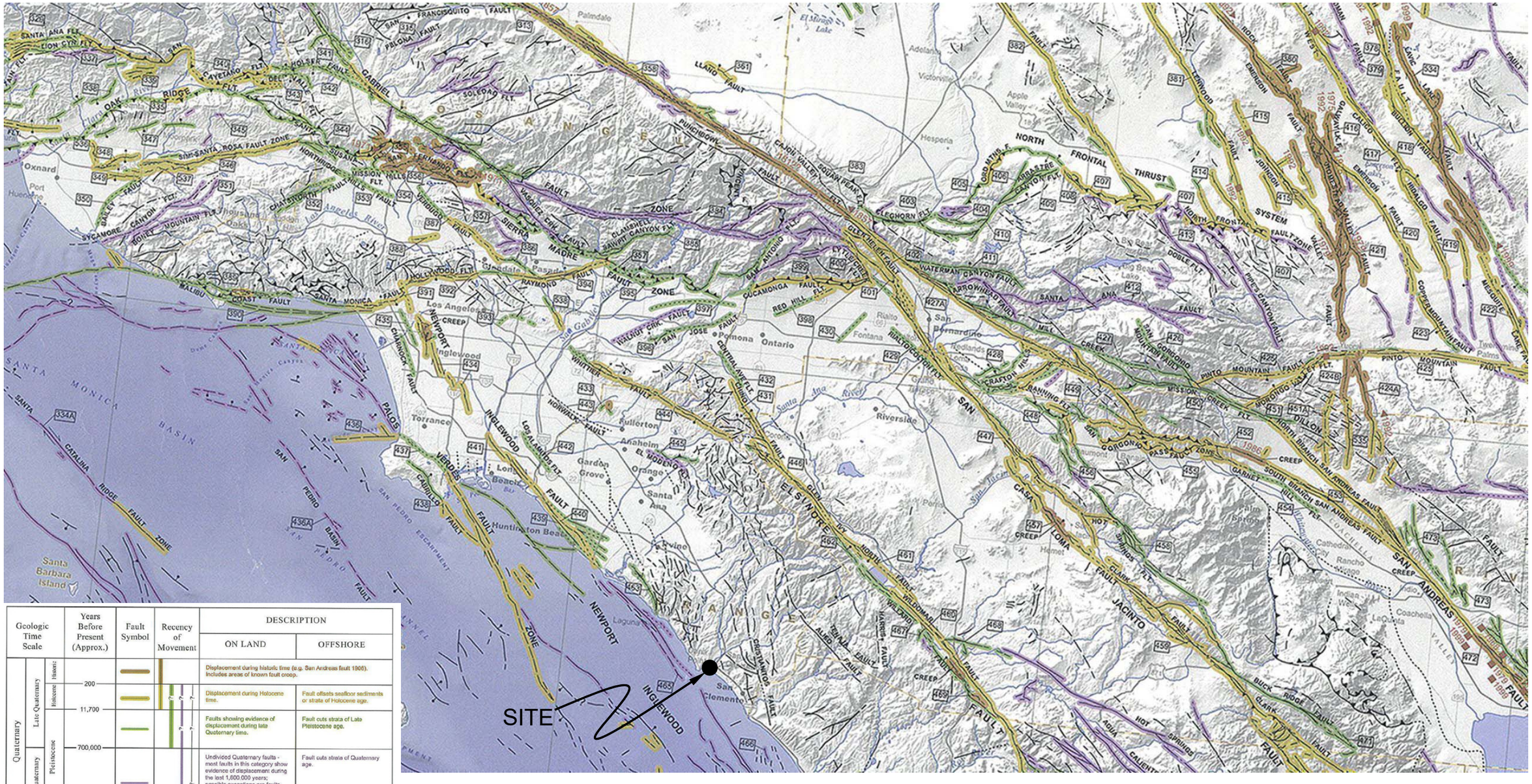
Drafted by: JTA	Checked by: NDB

SITE PLAN

VICTORIA BOULEVARD APARTMENTS
26126 VICTORIA BOULEVARD
DANA POINT, CALIFORNIA

MARCH 2019	PROJECT NO. A9942-88-01	FIG. 2

Reference: Jennings, C.W. and Bryant, W. A., 2010, Fault Activity Map of California, California Geological Survey Geologic Data Map No. 6.



Geologic Time Scale			Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION: ON LAND	DESCRIPTION: OFFSHORE
Quaternary	Late Quaternary	Historic	200			Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
		Holocene	11,700		? ? ?	Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
	Early Quaternary	Pleistocene	700,000		? ? ?	Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Late Pleistocene age.
					?	Undivided Quaternary faults - most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age.	Fault cuts strata of Quaternary age.
Pre-Quaternary			1,600,000*			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.	Fault cuts strata of Pliocene or older age.
			4.5 billion (Age of Earth)				

* Quaternary now recognized as extending to 2.6 Ma (Walker and Geissman, 2009). Quaternary faults in this map were established using the previous 1.6 Ma criterion.

N

0 12 24 Miles

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REGIONAL FAULT MAP

VICTORIA BOULEVARD APARTMENTS

26126 VICTORIA BOULEVARD
DANA POINT, CALIFORNIA

MARCH 2019	PROJECT NO. A9942-88-01	FIG. 3

SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
RIVERSIDE
IMPERIAL
SAN DIEGO
120°
33°
119°
SITE

EPICENTER MAP LEGEND

Period	1800 - 1868	1869 - 1931	1932 - 1999
≥ 7.0			
6.5 - 6.9			
6.0 - 6.4			
5.5 - 5.9			
5.0 - 5.4			

Magnitude (M)

- Historical Faulting
- Holocene Faulting
- Highways (Major)
- Highways (Minor)
- Lakes
- 65 — Last two digits of M ≥ 6.5 earthquake year

Reference: Toppozada, T., Branum, D., Petersen, M., Hallstrom, C., Cramer, C., and Reichle, M., 2000, Epicenters and Areas Damaged by M>5 California Earthquakes, 1800 - 1999, California Geological Survey, Map Sheet 49.

0 20 40 Miles

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REGIONAL SEISMICITY MAP

VICTORIA BOULEVARD APARTMENTS
26126 VICTORIA BOULEVARD
DANA POINT, CALIFORNIA

MARCH 2019 | PROJECT NO. A9942-88-01 | FIG. 4

GEOCON

Client : Toll Brothers
File No. : A9942-88-01
Boring : 4

EMPIRICAL ESTIMATION OF LIQUEFACTION POTENTIAL
DESIGN EARTHQUAKE

NCEER (1996) METHOD
EARTHQUAKE INFORMATION:

Earthquake Magnitude:	6.68
Peak Horiz. Acceleration PGA_M (g):	0.553
2/3 PGA_M (g):	0.369
Calculated Mag.Wtg.Factor:	0.747
Historic High Groundwater:	5.0
Groundwater Depth During Exploration:	17.0

By Thomas F. Blake (1994-1996)
ENERGY & ROD CORRECTIONS:

Energy Correction (CE) for N60:	1.25
Rod Len.Corr.(CR)(0-no or 1-yes):	1.0
Bore Dia. Corr. (CB):	1.00
Sampler Corr. (CS):	1.20
Use Ksigma (0 or 1):	1.0

LIQUEFACTION CALCULATIONS:

Unit Wt. Water (pcf): 62.4

Depth to Base (ft)	Total Unit Wt. (pcf)	Water (0 or 1)	FIELD SPT (N)	Depth of SPT (ft)	Liq.Sus. (0 or 1)	-200 (%)	Est. Dr (%)	CN Factor	Corrected (N1)60	Eff. Unit Wt. (psf)	Resist. CRR	rd Factor	Induced CSR	Liquefac. Safe.Fact.
1.0	120.0	0	9.0	1.0	0			1.700	17.2	120.0	~	0.998	0.179	~
2.0	120.0	0	9.0	2.0	0			1.700	17.2	120.0	~	0.993	0.178	~
3.0	120.0	0	9.0	3.0	0			1.700	17.2	120.0	~	0.989	0.177	~
4.0	120.0	0	9.0	4.0	0			1.700	17.2	120.0	~	0.984	0.176	~
5.0	120.0	0	9.0	5.0	0			1.700	17.2	120.0	~	0.979	0.175	~
6.0	120.0	1	6.0	6.0	0			1.700	11.5	57.6	~	0.975	0.183	~
7.0	120.0	1	6.0	7.0	0			1.636	11.0	57.6	~	0.970	0.197	~
8.0	120.0	1	6.0	8.0	0			1.523	10.3	57.6	~	0.966	0.209	~
9.0	120.0	1	6.0	9.0	0			1.431	9.7	57.6	~	0.961	0.219	~
10.0	120.0	1	6.0	10.0	0			1.353	9.1	57.6	~	0.957	0.227	~
11.0	120.0	1	6.0	10.0	0			1.287	8.7	57.6	~	0.952	0.234	~
12.0	120.0	1	4.0	10.0	0			1.230	5.5	57.6	~	0.947	0.240	~
13.0	120.0	1	4.0	12.5	0			1.180	5.3	57.6	~	0.943	0.245	~
14.0	120.0	1	4.0	12.5	0			1.135	5.1	57.6	~	0.938	0.250	~
15.0	120.0	1	4.0	12.5	0			1.095	4.9	57.6	~	0.934	0.254	~
16.0	120.0	1	4.0	12.5	0			1.060	4.8	57.6	~	0.929	0.257	~
17.0	120.0	1	2.0	17.5	0			1.035	2.7	57.6	~	0.925	0.260	~
18.0	120.0	1	2.0	17.5	0			1.020	2.6	57.6	~	0.920	0.262	~
19.0	120.0	1	2.0	17.5	0			1.006	2.6	57.6	~	0.915	0.264	~
20.0	120.0	1	2.0	17.5	0			0.992	2.5	57.6	~	0.911	0.266	~
21.0	120.0	1	2.0	17.5	0			0.979	2.5	57.6	~	0.906	0.268	~
22.0	120.0	1	3.0	22.5	0			0.966	4.0	57.6	~	0.902	0.269	~
23.0	120.0	1	3.0	22.5	0			0.954	4.0	57.6	~	0.897	0.270	~
24.0	120.0	1	3.0	22.5	0			0.942	3.9	57.6	~	0.893	0.271	~
25.0	120.0	1	3.0	22.5	0			0.931	3.9	57.6	~	0.888	0.271	~
26.0	120.0	1	3.0	22.5	0			0.920	3.8	57.6	~	0.883	0.272	~
27.0	120.0	1	2.0	27.5	0			0.909	2.7	57.6	~	0.879	0.272	~
28.0	120.0	1	2.0	27.5	0			0.899	2.6	57.6	~	0.874	0.273	~
29.0	120.0	1	2.0	27.5	0			0.889	2.6	57.6	~	0.870	0.273	~
30.0	120.0	1	2.0	27.5	0			0.880	2.6	57.6	~	0.865	0.273	~
31.0	120.0	1	2.0	27.5	0			0.871	2.6	57.6	~	0.861	0.273	~
32.0	120.0	1	3.0	32.5	0			0.862	3.9	57.6	~	0.856	0.273	~
33.0	120.0	1	3.0	32.5	0			0.853	3.8	57.6	~	0.851	0.272	~
34.0	120.0	1	3.0	32.5	0			0.844	3.8	57.6	~	0.847	0.272	~
35.0	120.0	1	4.0	37.5	0			0.836	5.0	57.6	~	0.842	0.272	~
36.0	120.0	1	4.0	37.5	0			0.828	5.0	57.6	~	0.838	0.271	~
37.0	120.0	1	4.0	37.5	0			0.821	4.9	57.6	~	0.833	0.271	~
38.0	120.0	1	4.0	37.5	0			0.813	4.9	57.6	~	0.829	0.270	~
39.0	120.0	1	4.0	37.5	0			0.806	4.8	57.6	~	0.824	0.270	~
40.0	120.0	1	4.0	37.5	0			0.799	4.8	57.6	~	0.819	0.269	~
41.0	120.0	1	4.0	37.5	0			0.792	4.8	57.6	~	0.815	0.268	~
42.0	120.0	1	6.0	42.5	0			0.785	7.1	57.6	~	0.810	0.267	~
43.0	120.0	1	6.0	42.5	0			0.778	7.0	57.6	~	0.806	0.267	~
44.0	120.0	1	6.0	42.5	0			0.772	6.9	57.6	~	0.801	0.266	~
45.0	120.0	1	6.0	42.5	0			0.766	6.9	57.6	~	0.797	0.265	~
46.0	120.0	1	6.0	42.5	0			0.760	6.8	57.6	~	0.792	0.264	~
47.0	120.0	1	18.0	47.5	0			0.754	20.3	57.6	~	0.787	0.263	~
48.0	120.0	1	18.0	47.5	0			0.748	20.2	57.6	~	0.783	0.262	~
49.0	120.0	1	18.0	47.5	0			0.742	20.0	57.6	~	0.778	0.261	~
50.0	120.0	1	18.0	47.5	0			0.736	19.9	57.6	~	0.774	0.260	~

GEOCON

Client : Toll Brothers
File No. : A9942-88-01
Boring : 4

LIQUEFACTION SETTLEMENT ANALYSIS
DESIGN EARTHQUAKE

(SATURATED SAND AT INITIAL LIQUEFACTION CONDITION)

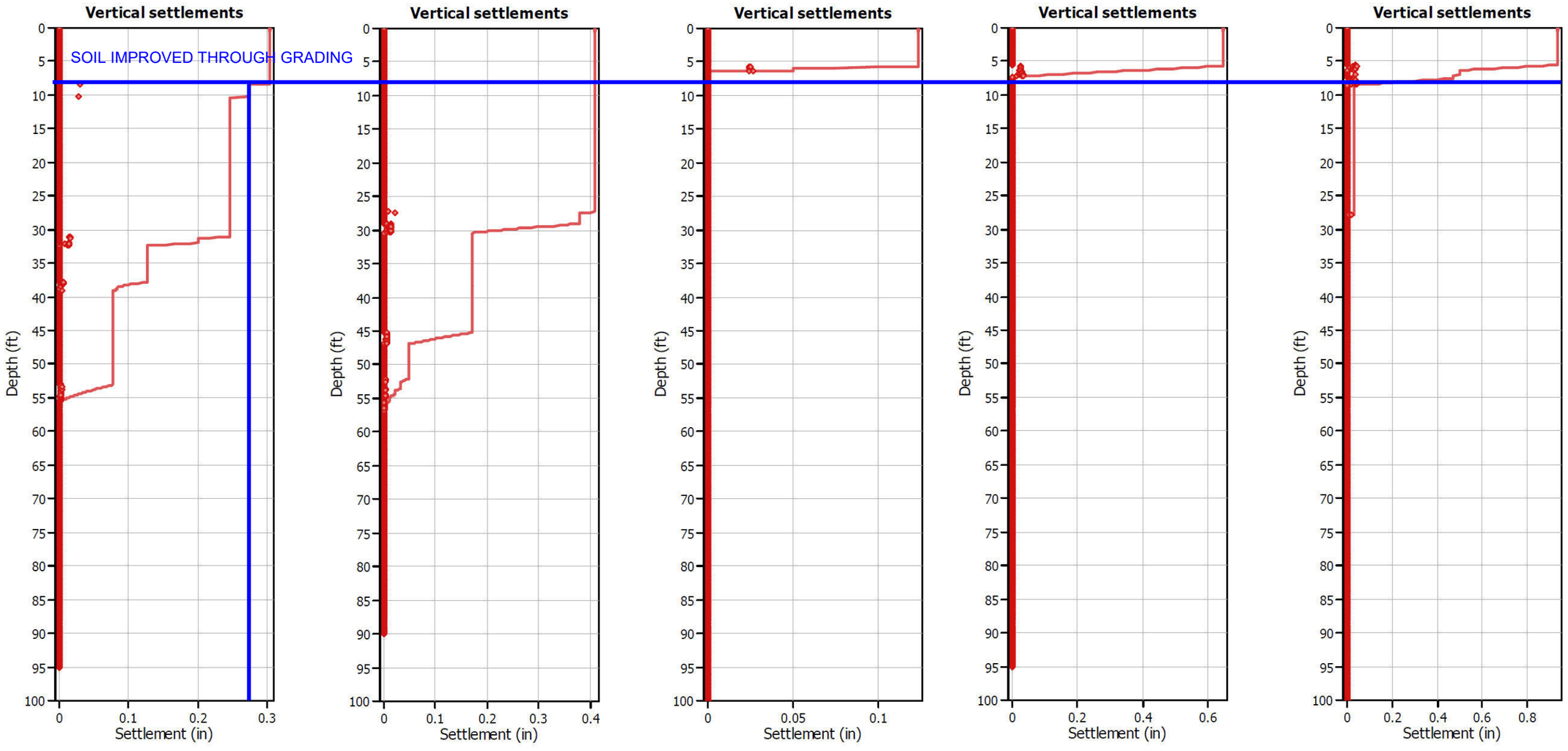
NCEER (1996) METHOD
EARTHQUAKE INFORMATION:

Earthquake Magnitude:	6.68
PGAM (g):	0.553
2/3 PGAM (g):	0.37
Calculated Mag.Wtg.Factor:	0.747
Historic High Groundwater:	5.0
Groundwater @ Exploration:	17.0

DEPTH TO BASE	BLOW COUNT N	WET DENSITY (PCF)	TOTAL STRESS O (TSF)	EFFECT STRESS O' (TSF)	REL. DEN. Dr (%)	ADJUST BLOWS (N1)60	Tav/σ'o	LIQUEFACTION SAFETY FACTOR	Volumetric Strain [e15] (%)	EQ. SETTLE. Pe (in.)
1	9	120	0.030	0.030		17	0.240	~	0.00	0.00
2	9	120	0.090	0.090		17	0.240	~	0.00	0.00
3	9	120	0.150	0.150		17	0.240	~	0.00	0.00
4	9	120	0.210	0.210		17	0.240	~	0.00	0.00
5	9	120	0.270	0.270		17	0.240	~	0.00	0.00
6	6	120	0.330	0.314		11	0.252	~	0.00	0.00
7	6	120	0.390	0.343		11	0.272	~	0.00	0.00
8	6	120	0.450	0.372		10	0.290	~	0.00	0.00
9	6	120	0.510	0.401		10	0.305	~	0.00	0.00
10	6	120	0.570	0.430		9	0.318	~	0.00	0.00
11	6	120	0.630	0.458		9	0.330	~	0.00	0.00
12	4	120	0.690	0.487		6	0.340	~	0.00	0.00
13	4	120	0.750	0.516		5	0.348	~	0.00	0.00
14	4	120	0.810	0.545		5	0.356	~	0.00	0.00
15	4	120	0.870	0.574		5	0.364	~	0.00	0.00
16	4	120	0.930	0.602		5	0.370	~	0.00	0.00
17	2	120	0.990	0.631		3	0.376	~	0.00	0.00
18	2	120	1.050	0.660		3	0.381	~	0.00	0.00
19	2	120	1.110	0.689		3	0.386	~	0.00	0.00
20	2	120	1.170	0.718		3	0.391	~	0.00	0.00
21	2	120	1.230	0.746		3	0.395	~	0.00	0.00
22	3	120	1.290	0.775		4	0.399	~	0.00	0.00
23	3	120	1.350	0.804		4	0.403	~	0.00	0.00
24	3	120	1.410	0.833		4	0.406	~	0.00	0.00
25	3	120	1.470	0.862		4	0.409	~	0.00	0.00
26	3	120	1.530	0.890		4	0.412	~	0.00	0.00
27	2	120	1.590	0.919		3	0.415	~	0.00	0.00
28	2	120	1.650	0.948		3	0.417	~	0.00	0.00
29	2	120	1.710	0.977		3	0.420	~	0.00	0.00
30	2	120	1.770	1.006		3	0.422	~	0.00	0.00
31	2	120	1.830	1.034		3	0.424	~	0.00	0.00
32	3	120	1.890	1.063		4	0.426	~	0.00	0.00
33	3	120	1.950	1.092		4	0.428	~	0.00	0.00
34	3	120	2.010	1.121		4	0.430	~	0.00	0.00
35	4	120	2.070	1.150		5	0.432	~	0.00	0.00
36	4	120	2.130	1.178		5	0.433	~	0.00	0.00
37	4	120	2.190	1.207		5	0.435	~	0.00	0.00
38	4	120	2.250	1.236		5	0.436	~	0.00	0.00
39	4	120	2.310	1.265		5	0.438	~	0.00	0.00
40	4	120	2.370	1.294		5	0.439	~	0.00	0.00
41	4	120	2.430	1.322		5	0.441	~	0.00	0.00
42	6	120	2.490	1.351		7	0.442	~	0.00	0.00
43	6	120	2.550	1.380		7	0.443	~	0.00	0.00
44	6	120	2.610	1.409		7	0.444	~	0.00	0.00
45	6	120	2.670	1.438		7	0.445	~	0.00	0.00
46	6	120	2.730	1.466		7	0.446	~	0.00	0.00
47	18	120	2.790	1.495		20	0.447	~	0.00	0.00
48	18	120	2.850	1.524		20	0.448	~	0.00	0.00
49	18	120	2.910	1.553		20	0.449	~	0.00	0.00
50	18	120	2.970	1.582		20	0.450	~	0.00	0.00

TOTAL SETTLEMENT = 0.0 INCHES

Figure 6



CPT 1

Total Anticiapted Settlement = 0.3 in

Anticiapted Settlement Subsequent to Recommended Grading = 0.25 in

CPT 2

Total Anticiapted Settlement = 0.41 in

Anticiapted Settlement Subsequent to Recommended Grading = 0.41 in

CPT 3

Total Anticiapted Settlement = 0.12 in

Anticiapted Settlement Subsequent to Recommended Grading = 0 in

CPT 4

Total Anticiapted Settlement = 0.65 in

Anticiapted Settlement Subsequent to Recommended Grading = 0 in

CPT 5

Total Anticiapted Settlement = 0.93 in

Anticiapted Settlement Subsequent to Recommended Grading = 0 in

GEOCON
WEST, INC.
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DE ESTIMATION OF LIQUEFACTION SETTLEMENTS

VICTORIA BOULEVARD APARTMENTS
26126 VICTORIA BOULEVARD
DANA POINT, CALIFORNIA

MARCH 2019 | PROJECT NO. A9942-88-01 | FIG. 7

GEOCON

Client : Toll Brothers
File No. : A9942-88-01
Boring : 4

EMPIRICAL ESTIMATION OF LIQUEFACTION POTENTIAL
MAXIMUM CONSIDERED EARTHQUAKE

NCEER (1996) METHOD
EARTHQUAKE INFORMATION:

Earthquake Magnitude:	6.72
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Historic High Groundwater:	5.0
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By Thomas F. Blake (1994-1996)
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Energy Correction (CE) for N60:	1.25
Rod Len.Corr.(CR)(0-no or 1-yes):	1.0
Bore Dia. Corr. (CB):	1.00
Sampler Corr. (CS):	1.20
Use Ksigma (0 or 1):	1.0

LIQUEFACTION CALCULATIONS:

Unit Wt. Water (pcf): 62.4

Depth to Base (ft)	Total Unit Wt. (pcf)	Water (0 or 1)	FIELD SPT (N)	Depth of SPT (ft)	Liq.Sus. (0 or 1)	-200 (%)	Est. Dr (%)	CN Factor	Corrected (N1)60	Eff. Unit Wt. (psf)	Resist. CRR	rd Factor	Induced CSR	Liquefac. Safe.Fact.
1.0	120.0	0	9.0	1.0	0			1.700	17.2	120.0	~	0.998	0.272	~
2.0	120.0	0	9.0	2.0	0			1.700	17.2	120.0	~	0.993	0.271	~
3.0	120.0	0	9.0	3.0	0			1.700	17.2	120.0	~	0.989	0.270	~
4.0	120.0	0	9.0	4.0	0			1.700	17.2	120.0	~	0.984	0.268	~
5.0	120.0	0	9.0	5.0	0			1.700	17.2	120.0	~	0.979	0.267	~
6.0	120.0	1	6.0	6.0	0			1.700	11.5	57.6	~	0.975	0.279	~
7.0	120.0	1	6.0	7.0	0			1.636	11.0	57.6	~	0.970	0.301	~
8.0	120.0	1	6.0	8.0	0			1.523	10.3	57.6	~	0.966	0.319	~
9.0	120.0	1	6.0	9.0	0			1.431	9.7	57.6	~	0.961	0.333	~
10.0	120.0	1	6.0	10.0	0			1.353	9.1	57.6	~	0.957	0.346	~
11.0	120.0	1	6.0	10.0	0			1.287	8.7	57.6	~	0.952	0.357	~
12.0	120.0	1	4.0	10.0	0			1.230	5.5	57.6	~	0.947	0.366	~
13.0	120.0	1	4.0	12.5	0			1.180	5.3	57.6	~	0.943	0.374	~
14.0	120.0	1	4.0	12.5	0			1.135	5.1	57.6	~	0.938	0.380	~
15.0	120.0	1	4.0	12.5	0			1.095	4.9	57.6	~	0.934	0.386	~
16.0	120.0	1	4.0	12.5	0			1.060	4.8	57.6	~	0.929	0.391	~
17.0	120.0	1	2.0	17.5	0			1.035	2.7	57.6	~	0.925	0.395	~
18.0	120.0	1	2.0	17.5	0			1.020	2.6	57.6	~	0.920	0.399	~
19.0	120.0	1	2.0	17.5	0			1.006	2.6	57.6	~	0.915	0.402	~
20.0	120.0	1	2.0	17.5	0			0.992	2.5	57.6	~	0.911	0.405	~
21.0	120.0	1	2.0	17.5	0			0.979	2.5	57.6	~	0.906	0.407	~
22.0	120.0	1	3.0	22.5	0			0.966	4.0	57.6	~	0.902	0.409	~
23.0	120.0	1	3.0	22.5	0			0.954	4.0	57.6	~	0.897	0.411	~
24.0	120.0	1	3.0	22.5	0			0.942	3.9	57.6	~	0.893	0.412	~
25.0	120.0	1	3.0	22.5	0			0.931	3.9	57.6	~	0.888	0.413	~
26.0	120.0	1	3.0	22.5	0			0.920	3.8	57.6	~	0.883	0.414	~
27.0	120.0	1	2.0	27.5	0			0.909	2.7	57.6	~	0.879	0.415	~
28.0	120.0	1	2.0	27.5	0			0.899	2.6	57.6	~	0.874	0.415	~
29.0	120.0	1	2.0	27.5	0			0.889	2.6	57.6	~	0.870	0.415	~
30.0	120.0	1	2.0	27.5	0			0.880	2.6	57.6	~	0.865	0.415	~
31.0	120.0	1	2.0	27.5	0			0.871	2.6	57.6	~	0.861	0.415	~
32.0	120.0	1	3.0	32.5	0			0.862	3.9	57.6	~	0.856	0.415	~
33.0	120.0	1	3.0	32.5	0			0.853	3.8	57.6	~	0.851	0.415	~
34.0	120.0	1	3.0	32.5	0			0.844	3.8	57.6	~	0.847	0.414	~
35.0	120.0	1	4.0	37.5	0			0.836	5.0	57.6	~	0.842	0.414	~
36.0	120.0	1	4.0	37.5	0			0.828	5.0	57.6	~	0.838	0.413	~
37.0	120.0	1	4.0	37.5	0			0.821	4.9	57.6	~	0.833	0.412	~
38.0	120.0	1	4.0	37.5	0			0.813	4.9	57.6	~	0.829	0.411	~
39.0	120.0	1	4.0	37.5	0			0.806	4.8	57.6	~	0.824	0.410	~
40.0	120.0	1	4.0	37.5	0			0.799	4.8	57.6	~	0.819	0.409	~
41.0	120.0	1	4.0	37.5	0			0.792	4.8	57.6	~	0.815	0.408	~
42.0	120.0	1	6.0	42.5	0			0.785	7.1	57.6	~	0.810	0.407	~
43.0	120.0	1	6.0	42.5	0			0.778	7.0	57.6	~	0.806	0.406	~
44.0	120.0	1	6.0	42.5	0			0.772	6.9	57.6	~	0.801	0.405	~
45.0	120.0	1	6.0	42.5	0			0.766	6.9	57.6	~	0.797	0.403	~
46.0	120.0	1	6.0	42.5	0			0.760	6.8	57.6	~	0.792	0.402	~
47.0	120.0	1	18.0	47.5	0			0.754	20.3	57.6	~	0.787	0.401	~
48.0	120.0	1	18.0	47.5	0			0.748	20.2	57.6	~	0.783	0.399	~
49.0	120.0	1	18.0	47.5	0			0.742	20.0	57.6	~	0.778	0.398	~
50.0	120.0	1	18.0	47.5	0			0.736	19.9	57.6	~	0.774	0.396	~

Figure 8

GEOCON

Client : Toll Brothers
File No. : A9942-88-01
Boring : 4

LIQUEFACTION SETTLEMENT ANALYSIS
MAXIMUM CONSIDERED EARTHQUAKE

(SATURATED SAND AT INITIAL LIQUEFACTION CONDITION)

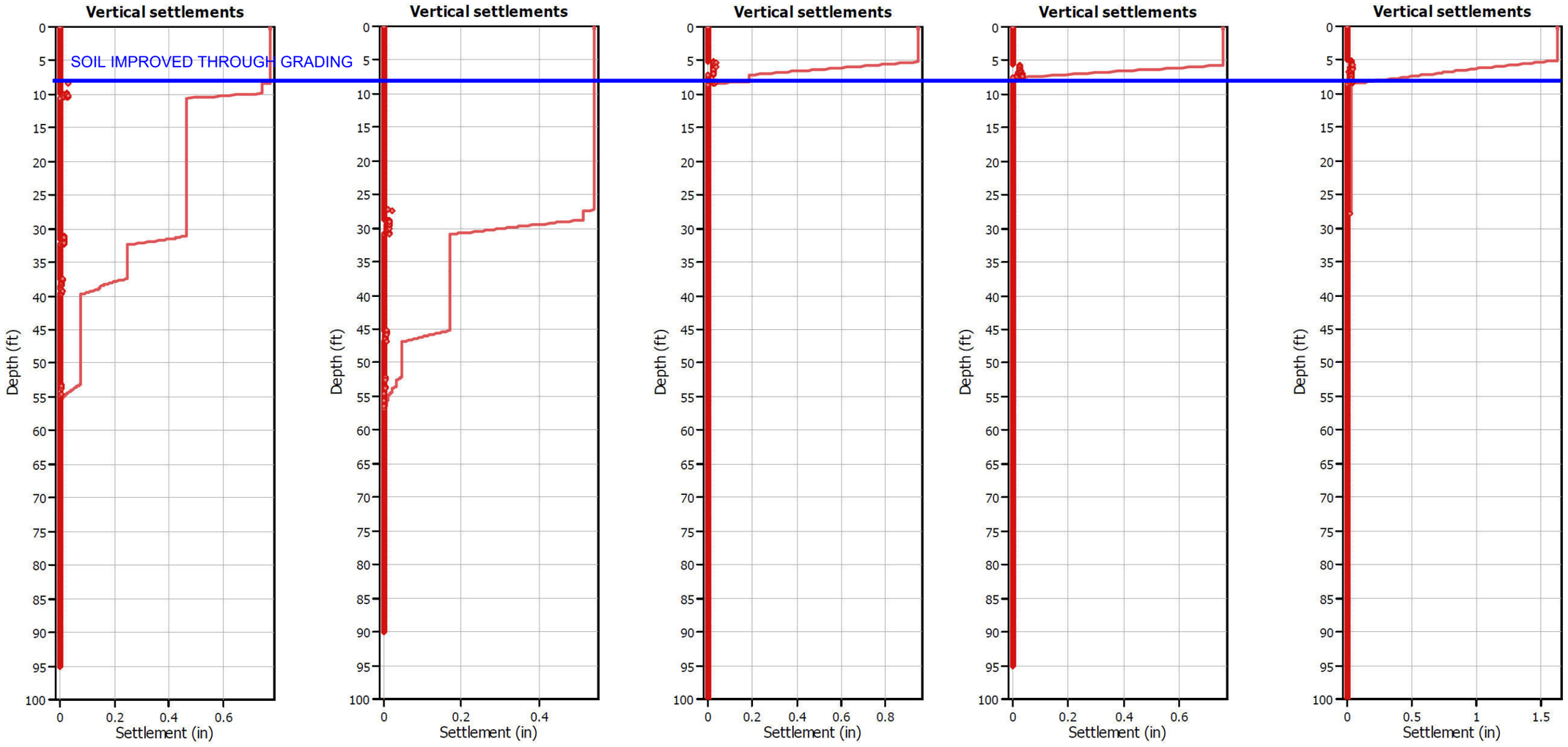
NCEER (1996) METHOD
EARTHQUAKE INFORMATION:

Earthquake Magnitude:	6.72
PGA_M (g):	0.553
Calculated Mag.Wtg.Factor:	0.759
Historic High Groundwater:	5.0
Groundwater @ Exploration:	17.0

DEPTH TO BASE	BLOW COUNT N	WET DENSITY (PCF)	TOTAL STRESS O (TSF)	EFFECT STRESS O' (TSF)	REL. DEN. Dr (%)	ADJUST BLOWS (N1)60	Tav/σ'o	LIQUEFACTION SAFETY FACTOR	Volumetric Strain [e_{15}} (%)	EQ. SETTLE. Pe (in.)
1	9	120	0.030	0.030		17	0.359	~	0.00	0.00
2	9	120	0.090	0.090		17	0.359	~	0.00	0.00
3	9	120	0.150	0.150		17	0.359	~	0.00	0.00
4	9	120	0.210	0.210		17	0.359	~	0.00	0.00
5	9	120	0.270	0.270		17	0.359	~	0.00	0.00
6	6	120	0.330	0.314		11	0.377	~	0.00	0.00
7	6	120	0.390	0.343		11	0.408	~	0.00	0.00
8	6	120	0.450	0.372		10	0.435	~	0.00	0.00
9	6	120	0.510	0.401		10	0.457	~	0.00	0.00
10	6	120	0.570	0.430		9	0.477	~	0.00	0.00
11	6	120	0.630	0.458		9	0.494	~	0.00	0.00
12	4	120	0.690	0.487		6	0.509	~	0.00	0.00
13	4	120	0.750	0.516		5	0.522	~	0.00	0.00
14	4	120	0.810	0.545		5	0.534	~	0.00	0.00
15	4	120	0.870	0.574		5	0.545	~	0.00	0.00
16	4	120	0.930	0.602		5	0.555	~	0.00	0.00
17	2	120	0.990	0.631		3	0.564	~	0.00	0.00
18	2	120	1.050	0.660		3	0.572	~	0.00	0.00
19	2	120	1.110	0.689		3	0.579	~	0.00	0.00
20	2	120	1.170	0.718		3	0.586	~	0.00	0.00
21	2	120	1.230	0.746		3	0.592	~	0.00	0.00
22	3	120	1.290	0.775		4	0.598	~	0.00	0.00
23	3	120	1.350	0.804		4	0.604	~	0.00	0.00
24	3	120	1.410	0.833		4	0.609	~	0.00	0.00
25	3	120	1.470	0.862		4	0.613	~	0.00	0.00
26	3	120	1.530	0.890		4	0.618	~	0.00	0.00
27	2	120	1.590	0.919		3	0.622	~	0.00	0.00
28	2	120	1.650	0.948		3	0.626	~	0.00	0.00
29	2	120	1.710	0.977		3	0.629	~	0.00	0.00
30	2	120	1.770	1.006		3	0.633	~	0.00	0.00
31	2	120	1.830	1.034		3	0.636	~	0.00	0.00
32	3	120	1.890	1.063		4	0.639	~	0.00	0.00
33	3	120	1.950	1.092		4	0.642	~	0.00	0.00
34	3	120	2.010	1.121		4	0.645	~	0.00	0.00
35	4	120	2.070	1.150		5	0.647	~	0.00	0.00
36	4	120	2.130	1.178		5	0.650	~	0.00	0.00
37	4	120	2.190	1.207		5	0.652	~	0.00	0.00
38	4	120	2.250	1.236		5	0.654	~	0.00	0.00
39	4	120	2.310	1.265		5	0.656	~	0.00	0.00
40	4	120	2.370	1.294		5	0.659	~	0.00	0.00
41	4	120	2.430	1.322		5	0.661	~	0.00	0.00
42	6	120	2.490	1.351		7	0.662	~	0.00	0.00
43	6	120	2.550	1.380		7	0.664	~	0.00	0.00
44	6	120	2.610	1.409		7	0.666	~	0.00	0.00
45	6	120	2.670	1.438		7	0.668	~	0.00	0.00
46	6	120	2.730	1.466		7	0.669	~	0.00	0.00
47	18	120	2.790	1.495		20	0.671	~	0.00	0.00
48	18	120	2.850	1.524		20	0.672	~	0.00	0.00
49	18	120	2.910	1.553		20	0.674	~	0.00	0.00
50	18	120	2.970	1.582		20	0.675	~	0.00	0.00

TOTAL SETTLEMENT = 0.0 INCHES

Figure 9



CPT 1

Total Anticiapted Settlement = 0.77in

Anticiapted Settlement Subsequent to Recommended Grading = 0.77 in

CPT 2

Total Anticiapted Settlement = 0.54 in

Anticiapted Settlement Subsequent to Recommended Grading = 0.54 in

CPT 3

Total Anticiapted Settlement = 0.95 in

Anticiapted Settlement Subsequent to Recommended Grading = 0 in

CPT 4

Total Anticiapted Settlement = 0.76 in

Anticiapted Settlement Subsequent to Recommended Grading = 0 in

CPT 5

Total Anticiapted Settlement = 1.6 in

Anticiapted Settlement Subsequent to Recommended Grading = 0 in

GEOCON WEST, INC.
ENVIRONMENTAL GEOTECHNICAL MATERIALS
15520 ROCKFIELD BOULEVARD, SUITE J, IRVINE, CA 92618
PHONE (949) 491-6570

DRAFTED BY: JTA | CHECKED BY: JTA

MCE ESTIMATION OF LIQUEFACTION SETTLEMENTS

VICTORIA BOULEVARD APARTMENTS
26126 VICTORIA BOULEVARD
DANA POINT, CALIFORNIA

MARCH 2019 | PROJECT NO. A9942-88-01 | FIG. 10

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

- SPECIAL FLOOD HAZARD AREAS
  - Without Base Flood Elevation (BFE) *Zone A, V, A99*
  - With BFE or Depth *Zone AE, AO, AH, VE, AR*
  - Regulatory Floodway
- OTHER AREAS OF FLOOD HAZARD
  - 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
  - Future Conditions 1% Annual Chance Flood Hazard *Zone X*
  - Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
  - Area with Flood Risk due to Levee *Zone D*
- OTHER AREAS
  - NO SCREEN Area of Minimal Flood Hazard *Zone X*
  - Effective LOMRs
  - Area of Undetermined Flood Hazard *Zone D*
- GENERAL STRUCTURES
  - Channel, Culvert, or Storm Sewer
  - Levee, Dike, or Floodwall
- OTHER FEATURES
  - 20.2 Cross Sections with 1% Annual Chance
  - 17.5 Water Surface Elevation
  - Coastal Transect
  - Coastal Transect Baseline
  - Profile Baseline
  - Hydrographic Feature
  - 513 Base Flood Elevation Line (BFE)
  - Limit of Study
  - Jurisdiction Boundary

N

0 400' 800'

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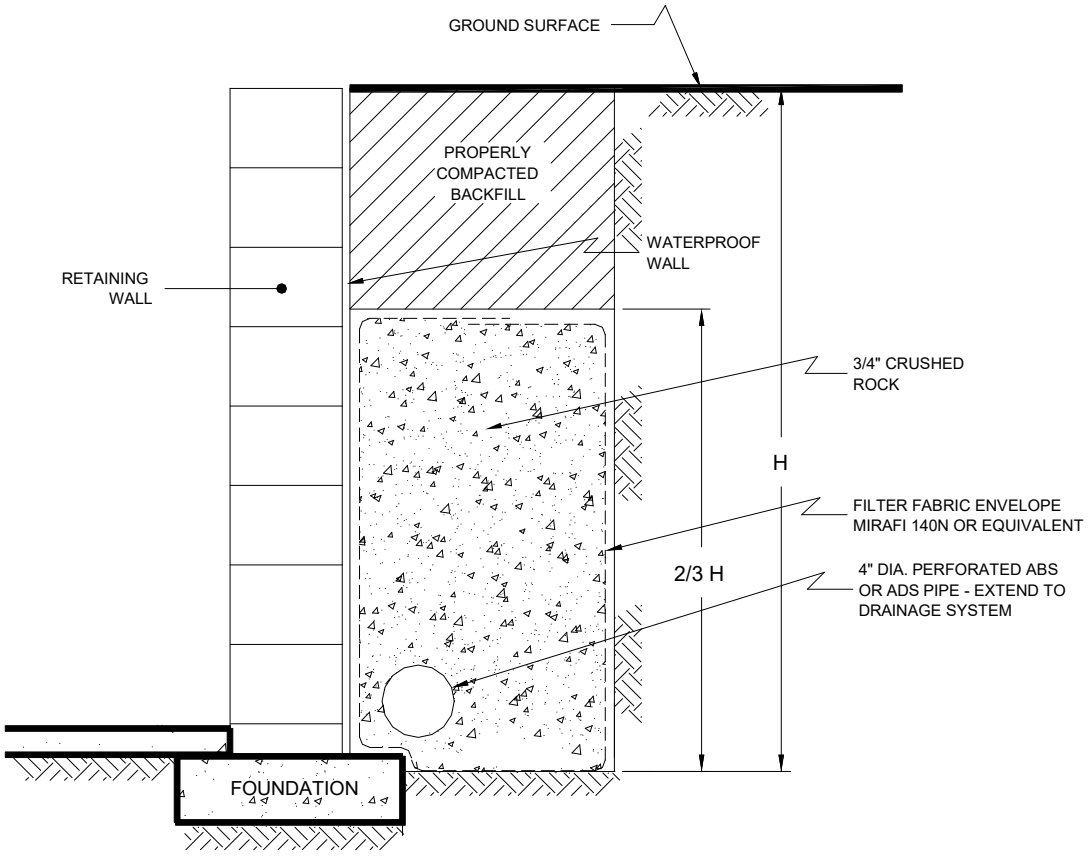
FLOOD ZONE MAP

VICTORIA BOULEVARD APARTMENTS
26126 VICTORIA BOULEVARD
DANA POINT, CALIFORNIA

MARCH 2019 | PROJECT NO. A9942-88-01 | FIG. 11



NO SCALE

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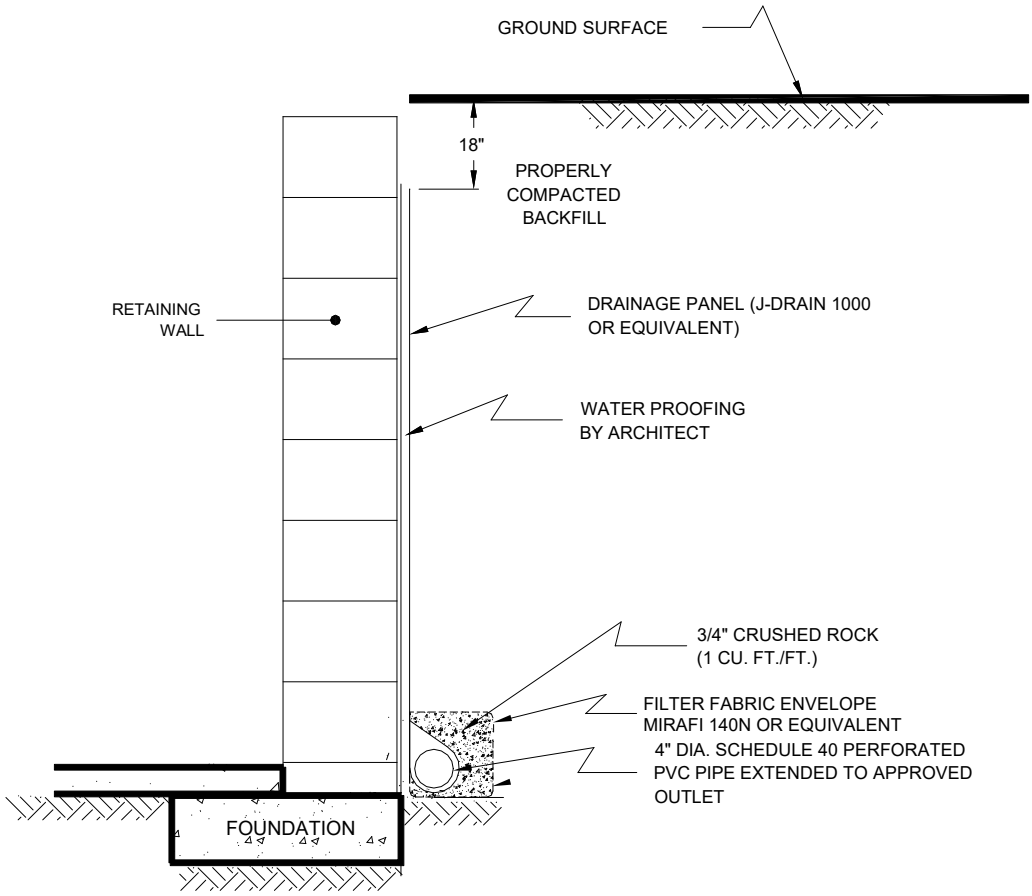
RETAINING WALL DRAINAGE

VICTORIA BOULEVARD APARTMENTS
26126 VICTORIA BOULEVARD
DANA POINT, CALIFORNIA

MARCH 2019	PROJECT NO. A9942-88-01	FIG. 12



NO SCALE

GEOCON WEST, INC.

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15520 ROCKFIELD BOULEVARD, SUITE J, IRVINE, CA 92618
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DRAFTED BY: JTA	CHECKED BY: NDB

RETAINING WALL DRAINAGE

VICTORIA BOULEVARD APARTMENTS
26126 VICTORIA BOULEVARD
DANA POINT, CALIFORNIA

MARCH 2019	PROJECT NO. A9942-88-01	FIG. 13

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

The site was explored on February 25, 2019, by excavating five 8-inch diameter borings to depths between 31½ and 51½ feet below the existing ground surface utilizing a truck-mounted hollow-stem auger drilling machine. Representative and relatively undisturbed samples were obtained by driving a 3-inch, O. D., California Modified Sampler into the "undisturbed" soil mass with blows from a 140-pound auto-hammer falling 30 inches. The California Modified Sampler was equipped with 1-inch high by 2$^{3}/_{8}$-inch diameter brass sampler rings to facilitate soil removal and testing. Bulk samples were also obtained in the upper 5-feet on each of the borings. Standard Penetration Tests (SPTs) were also performed. On February 27, 2019, five CPTs were advanced to depths between 90 and 100 feet below the existing ground surface. The approximate locations of the exploratory borings and CPTs are depicted on the Site Plan (see Figure 2).

The soil conditions encountered in the borings were visually examined, classified and logged in general accordance with the Unified Soil Classification System (USCS). The logs of the hollow-stem auger borings are presented on Figures A1 through A5 and the logs of the CPTs are presented on Figures A6 through A10. The logs depict the soil and geologic conditions encountered and the depth at which samples were obtained. The logs also include our interpretation of the conditions between sampling intervals. Therefore, the logs contain both observed and interpreted data. We determined the lines designating the interface between soil materials on the logs using visual observations, penetration rates, excavation characteristics and other factors. The transition between materials may be abrupt or gradual. Where applicable, the boring logs were revised based on subsequent laboratory testing.

PROJECT NO. A9942-88-01

BORING 1

ELEV. (MSL.) -- DATE COMPLETED **02/25/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **SAF**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				**ASPHALT: 3" BASE: 6"** **ARTIFICIAL FILL** Sandy Silty Clay, soft, moist, brown.			
6	B1@5'				**ALLUVIUM** Silty Clay, soft, moist, brown.	5	70.6	15.7
10	B1@10'				- slightly reddish brown, sand in sample, mica present	7	101.5	20.7
16	B1@15'				- firm to stiff, dry to slightly moist, dark brown	26	98.9	24.2
18				CL				
20	B1@20'		▼		- pocket of oxidized Sandy Clay to Clayey very fine Sand in light to dark brown Sandy Silty Clay	14	99.3	24.1
26	B1@25'					6	96.2	28.5

A9942-88-01 BORING LOGS.GPJ

Figure A1,
Log of Boring 1, Page 1 of 2

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. A9942-88-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING 1** ELEV. (MSL.) -- DATE COMPLETED **02/25/2019** EQUIPMENT **HOLLOW STEM AUGER** BY: **SAF** MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B1@30'				Clayey Silty Sand, saturated, loose, light to dark brown, fine-grained.	8	113.4	17.5
32								
34								
36	B1@35'			SM	- medium dense, moist, light brown to gray with orange/gray mottled sand, fine- to medium-grained, mica present	26		15.9
38								
40	B1@40'				- tip of sample (~2") was Silty Clay, firm, moist, highly weathered Capistrano Formation	11		26.5
					Total depth of boring: 41.5 feet. Fill to 5 feet. Grounwater encountered at 20 feet. No caving. Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.			

A9942-88-01 BORING LOGS.GPJ

Figure A1,
Log of Boring 1, Page 2 of 2

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

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GEOCON

PROJECT NO. A9942-88-01

BORING 2

ELEV. (MSL.) -- DATE COMPLETED **02/25/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **JF**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				**ASPHALT: 4" BASE: 4"** **ARTIFICIAL FILL** Silty Clay, soft to firm, moist, gray brown.			
4	B2@5'			CL	**ALLUVIUM** Sandy Clay and Silty Clay, soft to firm, moist, brown.	20	103.9	23.2
10	B2@10'			SM/ML	Silty Sand and Sandy Clayey Silt, loose to medium-dense and soft to firm, moist, light brown, fine-grained, some clay partings, scattered cobble.	13	106.6	13.5
16	B2@15'		▼		- sample distrubed, only 3 rings recovered	49	114.8	20.2
20	B2@20'				- no recovery, driller reports difficult drilling, cobbles/gravel	31		
25	B2@25'				**CAPISTRANO FORMATION (Tcs)** Silty Sandstone and Sandy Siltstone, moderately weathered, gray.	24		38.7

A9942-88-01 BORING LOGS.GPJ

Figure A2,
Log of Boring 2, Page 1 of 2

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. A9942-88-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING 2** ELEV. (MSL.) -- DATE COMPLETED **02/25/2019** EQUIPMENT **HOLLOW STEM AUGER** BY: **JF**	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
30	B2@30'				- dark gray	67	97.7	36.9
					Total depth of boring: 31.5 feet. Fill to 4 feet. Groundwater encountered at 17 feet. No caving. Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.			

A9942-88-01 BORING LOGS.GPJ

Figure A2,
Log of Boring 2, Page 2 of 2

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. A9942-88-01

BORING 3

ELEV. (MSL.) -- DATE COMPLETED **02/25/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **JF**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				**CONCRETE: 4" BASE: 4"** **ARTIFICIAL FILL** Sandy Clayey Silt and Sandy Silt, soft, moist, reddish brown.			
2								
4					**ALLUVIUM** Sandy Clayey Silt, soft, moist, brown, scattered micas.			
6	B3@5'					13	111.1	25.9
8								
10	B3@10'					9	107.6	23.6
12								
14								
16	B3@15'					4	102.4	31.4
18			▼	ML				
20	B3@20'				- becomes sandier, sand stringers present	11	106.4	32.2
22								
24								
26	B3@25'					8	113.9	27.8
28								

A9942-88-01 BORING LOGS.GPJ

Figure A3,
Log of Boring 3, Page 1 of 2

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. A9942-88-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING 3** ELEV. (MSL.) -- DATE COMPLETED **02/25/2019** EQUIPMENT **HOLLOW STEM AUGER** BY: **JF**	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
30	B3@30'			ML		10	106.0	29.5
					Total depth of boring: 31.5 feet. Fill to 4 feet. Groundwater encountered at 19 feet. No caving. Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.			

A9942-88-01 BORING LOGS.GPJ

Figure A3,
Log of Boring 3, Page 2 of 2

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

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BORING 4

ELEV. (MSL.) -- DATE COMPLETED **02/25/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **JF**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				**CONCRETE: 4" BASE: 4"** **ARTIFICIAL FILL** Clayey and Silty Sand and Sandy Clayey Silt, loose and soft, moist, reddish brown.			
2	B4@2.5'					9		24.0
4								
6	B4@5'				**ALLUVIUM** Sandy Clayey Silt and Silty Clay, soft, moist to wet, olive brown, scattered mica.	10	113.6	22.1
8	B4@7.5'					6		21.9
	BULK 8-12'							
10	B4@10'					9	105.7	21.8
12				ML/CL				
	B4@12.5'				- sand lenses present	4		25.2
14								
	B4@15'					10	111.9	26.1
16			▼					
18	B4@17.5'				Silty Clay and Clayey Silt, very soft, moist to saturated, sand stringers.	2		31.0
20	B4@20'					5	105.8	32.5
22								
	B4@22.5'					3		29.7
24				ML/CH				
	B4@25'					9	105.7	28.7
26								
28	B4@27.5'					2		28.0

A9942-88-01 BORING LOGS.GPJ

Figure A4,
Log of Boring 4, Page 1 of 2

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

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BORING 4

ELEV. (MSL.) -- DATE COMPLETED **02/25/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **JF**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B4@30'				Silty Clay and Clayey Silt, very soft, moist to saturated.	9	107.8	29.0
32	B4@32.5'			ML/CL		3		28.7
34								
36	B4@35'				Sandy Clayey Silt, very soft to soft, moist, gray.	6	103.8	32.0
38	B4@37.5'					4		28.9
40	B4@40'			ML		10	96.0	36.0
42	B4@42.5'				- increase in sand content, still a Sandy Clayey Silt and Silty Sandy Clay	6		33.3
44								
46	B4@45'				Sandy Silty Clay, firm, moist, dark gray to gray.	19	108.1	26.9
48	B4@47.5'			CL		18		27.5
50	B4@50'					18	107.1	29.4
					Total depth of boring: 51.5 feet. Fill to 5 feet. Groundwater encountered at 17 feet. No caving. Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.			

A9942-88-01 BORING LOGS.GPJ

Figure A4,
Log of Boring 4, Page 2 of 2

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

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BORING 5

ELEV. (MSL.) -- DATE COMPLETED **02/25/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **SAF**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				**ASPHALT: 7" NO BASE** **ARTIFICIAL FILL** Silty Sand, loose to very loose, slightly moist, light to dark brown, fine-grained.			
4	B5@5'			CL	**ALLUVIUM** Silty Clay, soft, moist, gray to brownish gray.	10		7.6
10					- scattered small pebbles			
14	B5@15'		▼			7		17.2
20	B5@20'			ML	Sandy Clayey Silt, soft, slightly moist.	8		20.5
24	B5@25'			SC	Clayey Sand, medium dense, moist to wet, fine- to medium-grained.	27		20.0
28								

A9942-88-01 BORING LOGS.GPJ

Figure A5,
Log of Boring 5, Page 1 of 2

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING 5** ELEV. (MSL.) -- DATE COMPLETED **02/25/2019** EQUIPMENT **HOLLOW STEM AUGER** BY: **SAF**	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
30	B5@30'			CL	Silty Clay, very soft to soft, moist to wet, brown with occasional pockets of fine- to medium-grained sand.	9		21.5
32								
34								
36	B5@35'			ML	**CAPISTRANO FORMATION (Tcs)** Clayey and Sandy Siltstone, moderately weathered, gray.	15	92.5	40.8
38								
40					Total depth of boring: 40 feet. Fill to 4 feet. Groundwater encountered at 16 feet. No caving. Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.			

A9942-88-01 BORING LOGS.GPJ

Figure A5,
Log of Boring 5, Page 2 of 2

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL ◧ ... STANDARD PENETRATION TEST ■ ... DRIVE SAMPLE (UNDISTURBED)

⊠ ... DISTURBED OR BAG SAMPLE ◥ ... CHUNK SAMPLE ▼ ... WATER TABLE OR SEEPAGE

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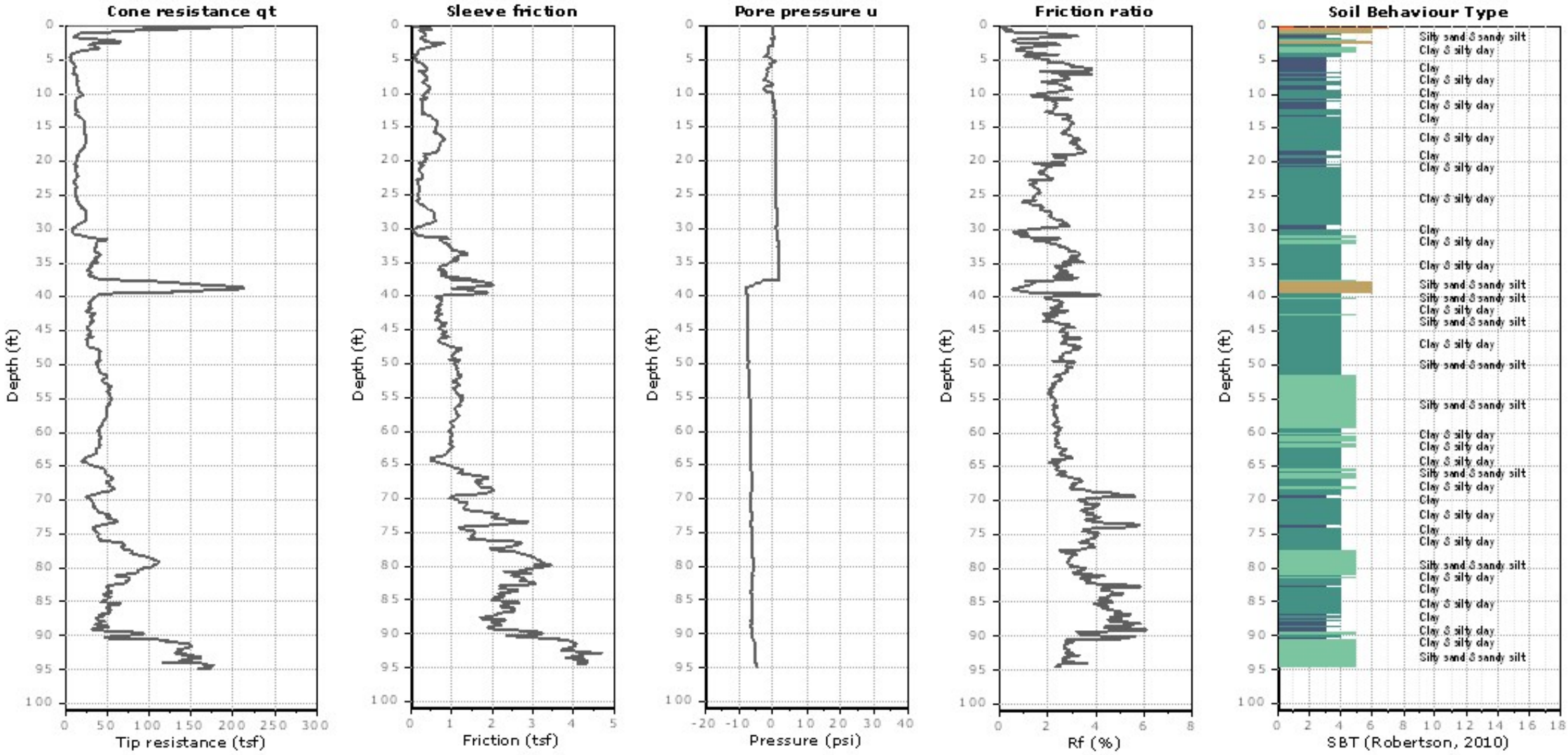
steve@kehoetesting.com
www.kehoetesting.com

CPT-1

Project: **Geocon West**
Location: **26126 Victoria Blvd, Dana Point, CA**

Total depth: 95.08 ft, Date: 2/26/2019
Cone Type: Vertek



Geocon Project No. A9442-88-01

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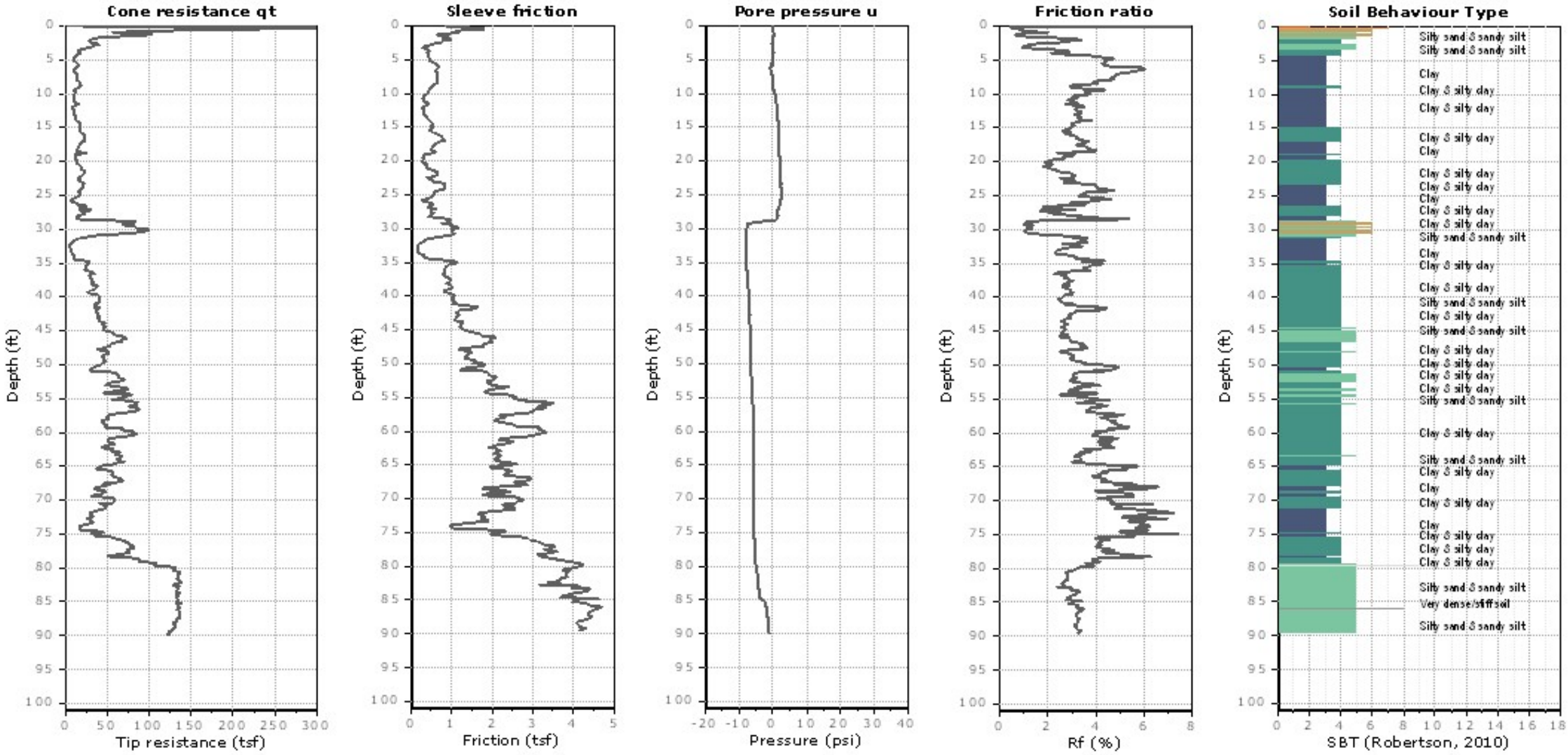
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

CPT-2

Project: **Geocon West**
Location: **26126 Victoria Blvd, Dana Point, CA**

Total depth: 90.03 ft, Date: 2/26/2019
Cone Type: Vertek



Geocon Project No. A9442-88-01

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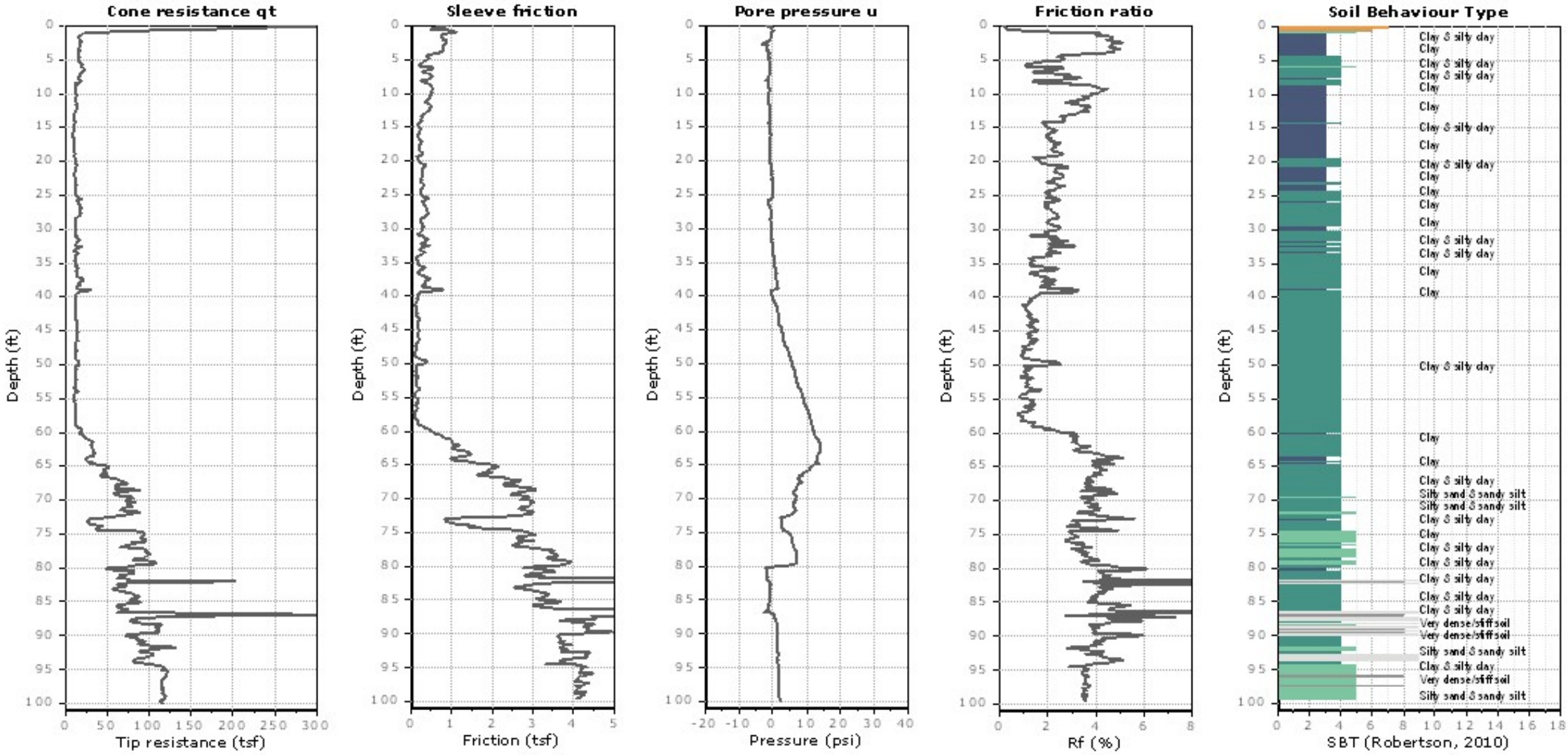
steve@kehoetesting.com
www.kehoetesting.com

CPT-3

Project: **Geocon West**
Location: **26126 Victoria Blvd, Dana Point, CA**

Total depth: 100.07 ft, Date: 2/26/2019
Cone Type: Vertek



Geocon Project No. A9442-88-01

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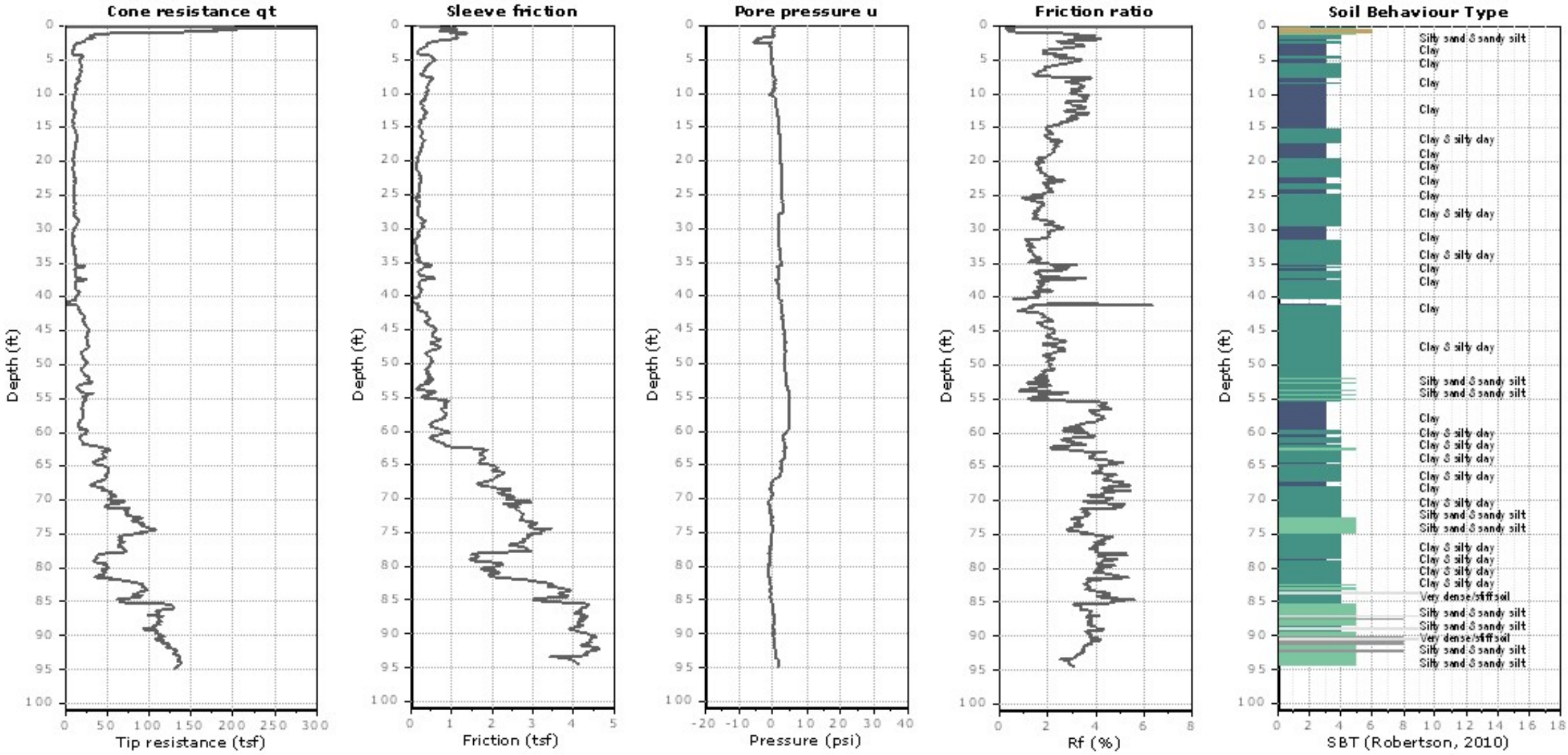
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

CPT-4

Project: **Geocon West**
Total depth: 95.03 ft, Date: 2/26/2019

Location: **26126 Victoria Blvd, Dana Point, CA**
Cone Type: Vertek



Geocon Project No. A9442-88-01

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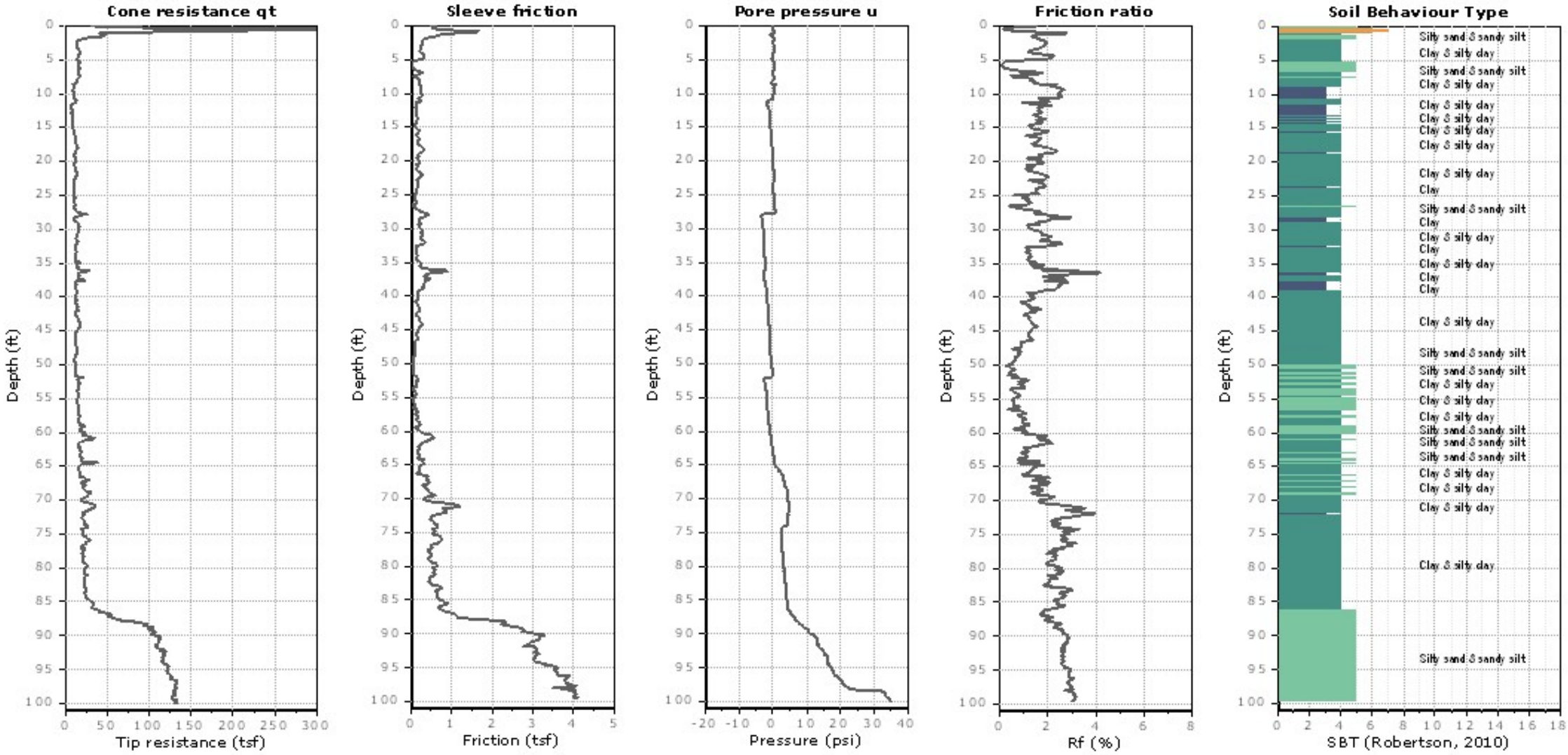
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

CPT-5

Project: **Geocon West**
Total depth: 100.07 ft, Date: 2/26/2019

Location: **26126 Victoria Blvd, Dana Point, CA**
Cone Type: Vertek



Geocon Project No. A9442-88-01

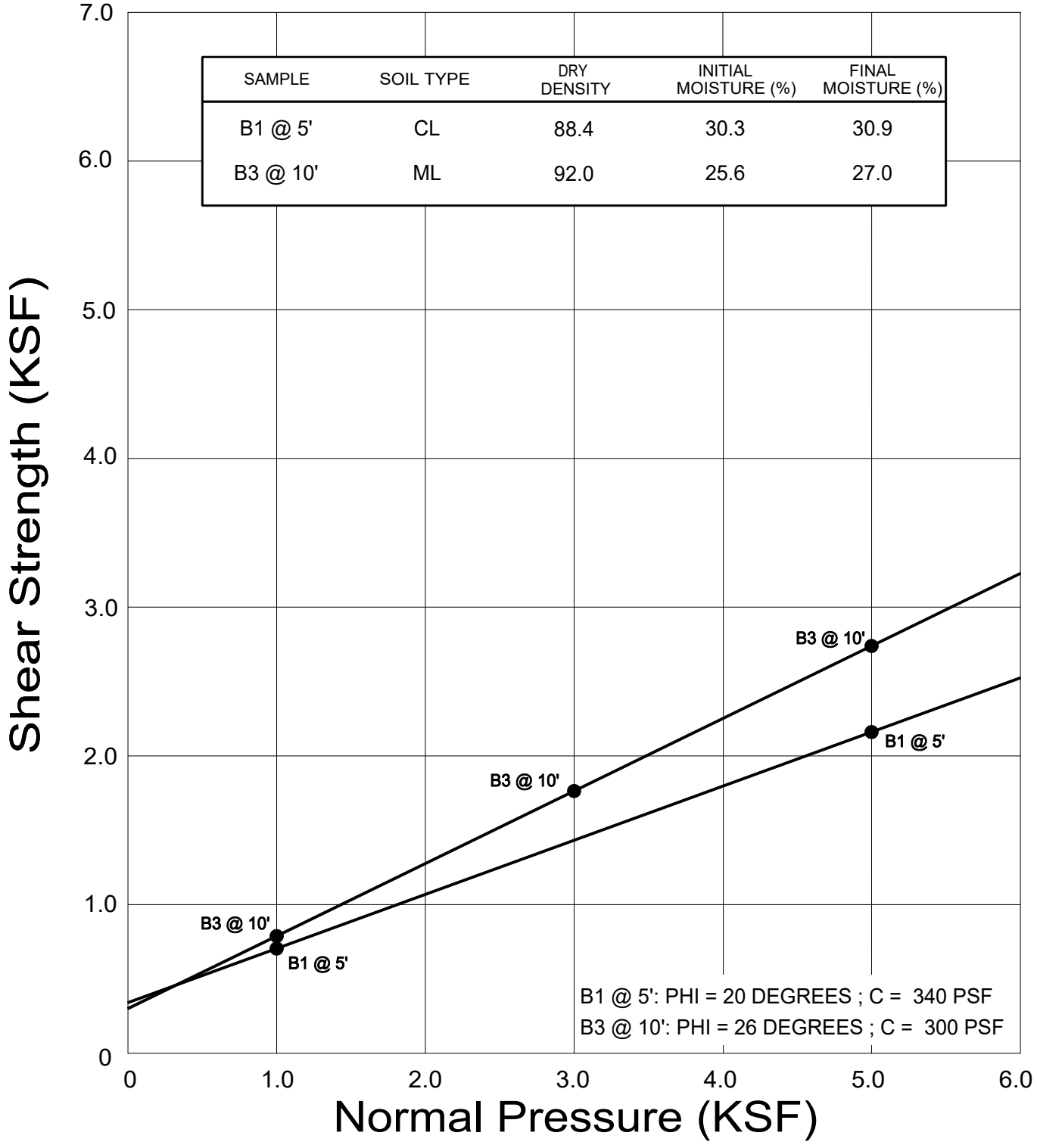
APPENDIX B

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the "American Society for Testing and Materials (ASTM)", or other suggested procedures. Selected samples were tested for direct shear strength, consolidation, expansion characteristics, Atterberg limits, corrosivity, and in-place dry density and moisture content. The results of the laboratory tests are summarized in Figures B1 through B10. The in-place dry density and moisture content of the samples tested are presented on the boring logs, Appendix A.

SAMPLE	SOIL TYPE	DRY DENSITY	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1 @ 5'	CL	88.4	30.3	30.9
B3 @ 10'	ML	92.0	25.6	27.0



● Direct Shear, Saturated

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DIRECT SHEAR TEST RESULTS

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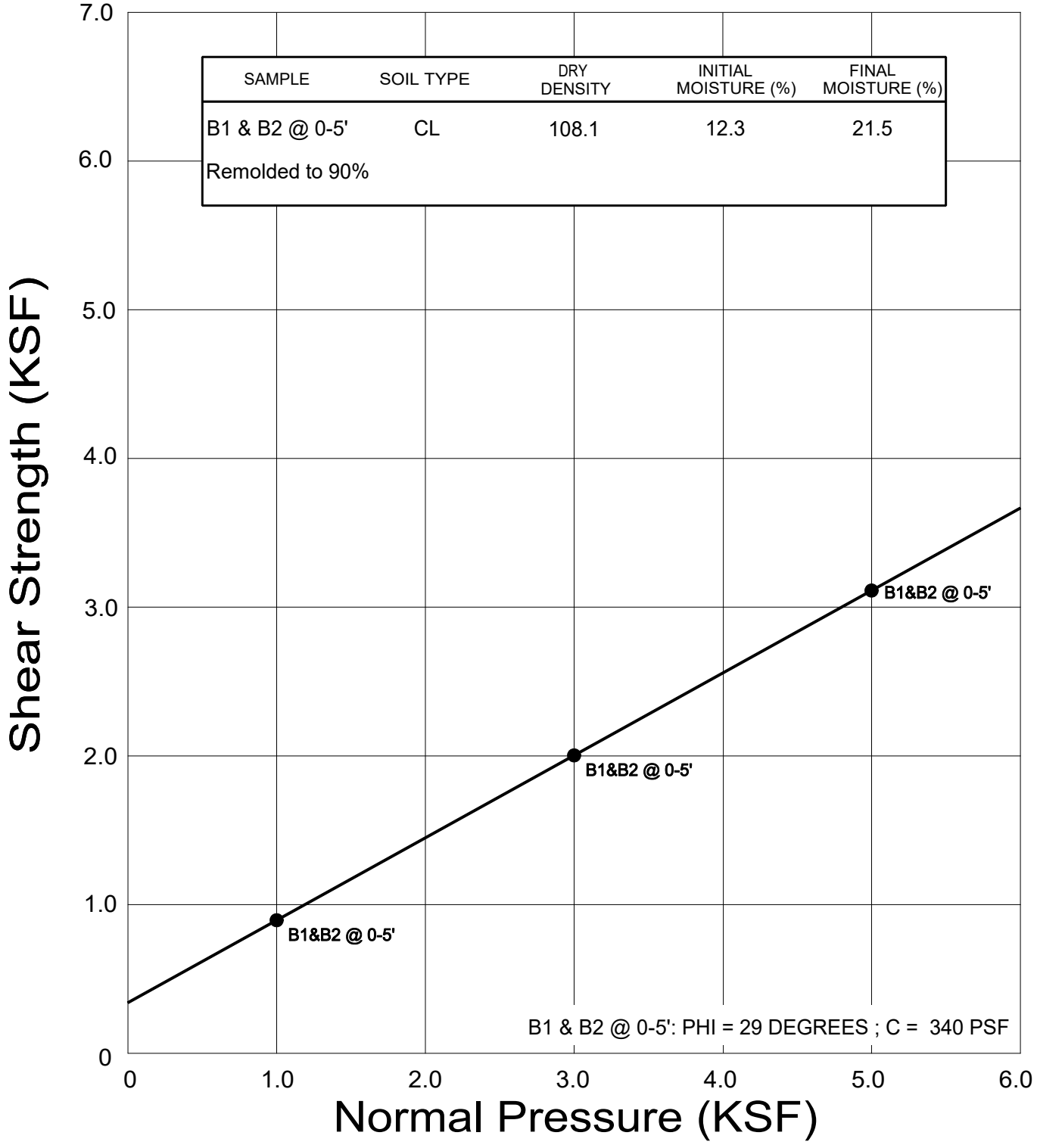
DANA POINT, CALIFORNIA

MARCH 2019 | PROJECT NO. A9942-88-01 | FIG. B1

SAMPLE	SOIL TYPE	DRY DENSITY	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1 & B2 @ 0-5'	CL	108.1	12.3	21.5
Remolded to 90%				



● Direct Shear, Saturated

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DIRECT SHEAR TEST RESULTS

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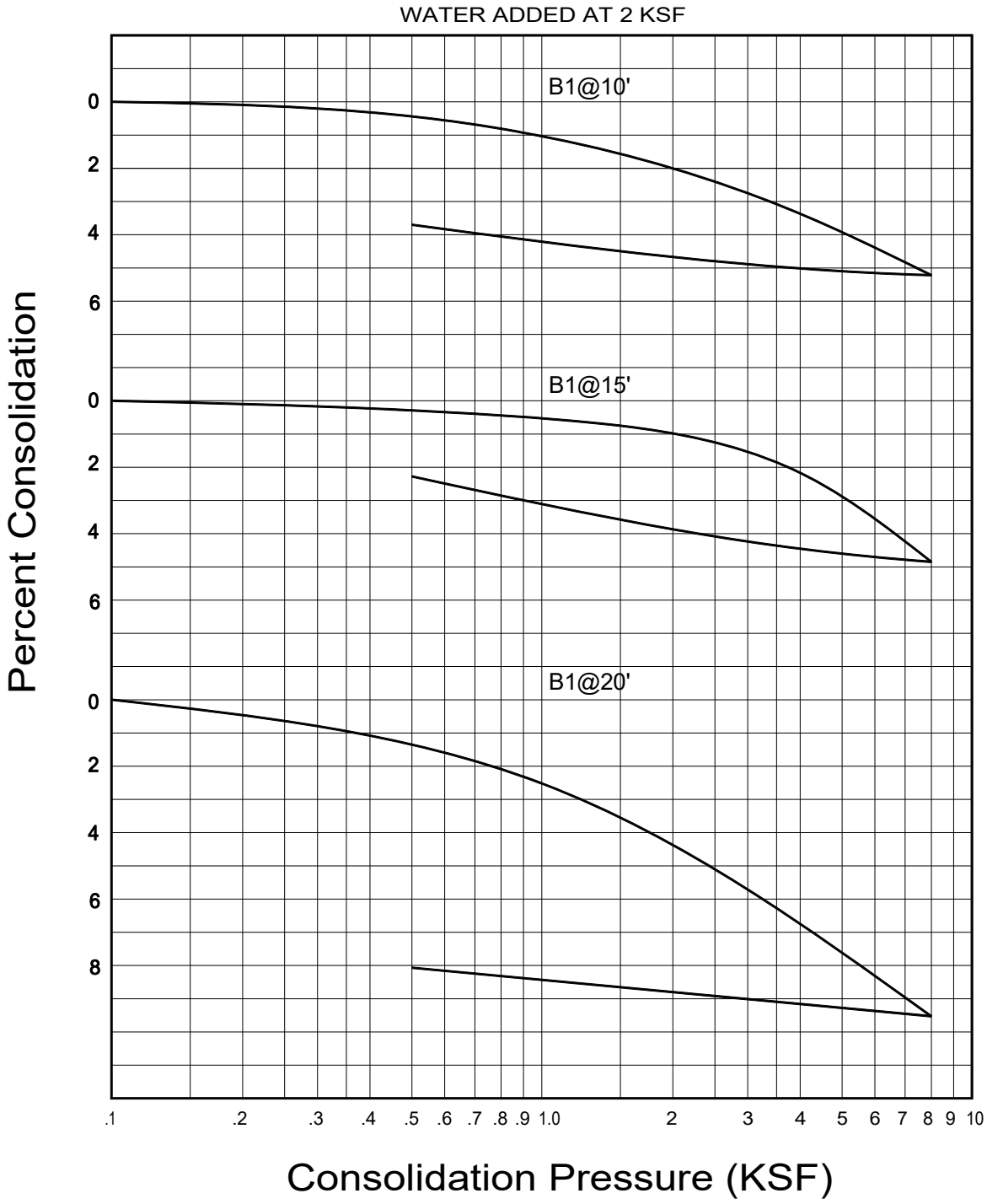
MARCH 2019	PROJECT NO. A9942-88-01	FIG. B2



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CONSOLIDATION TEST RESULTS

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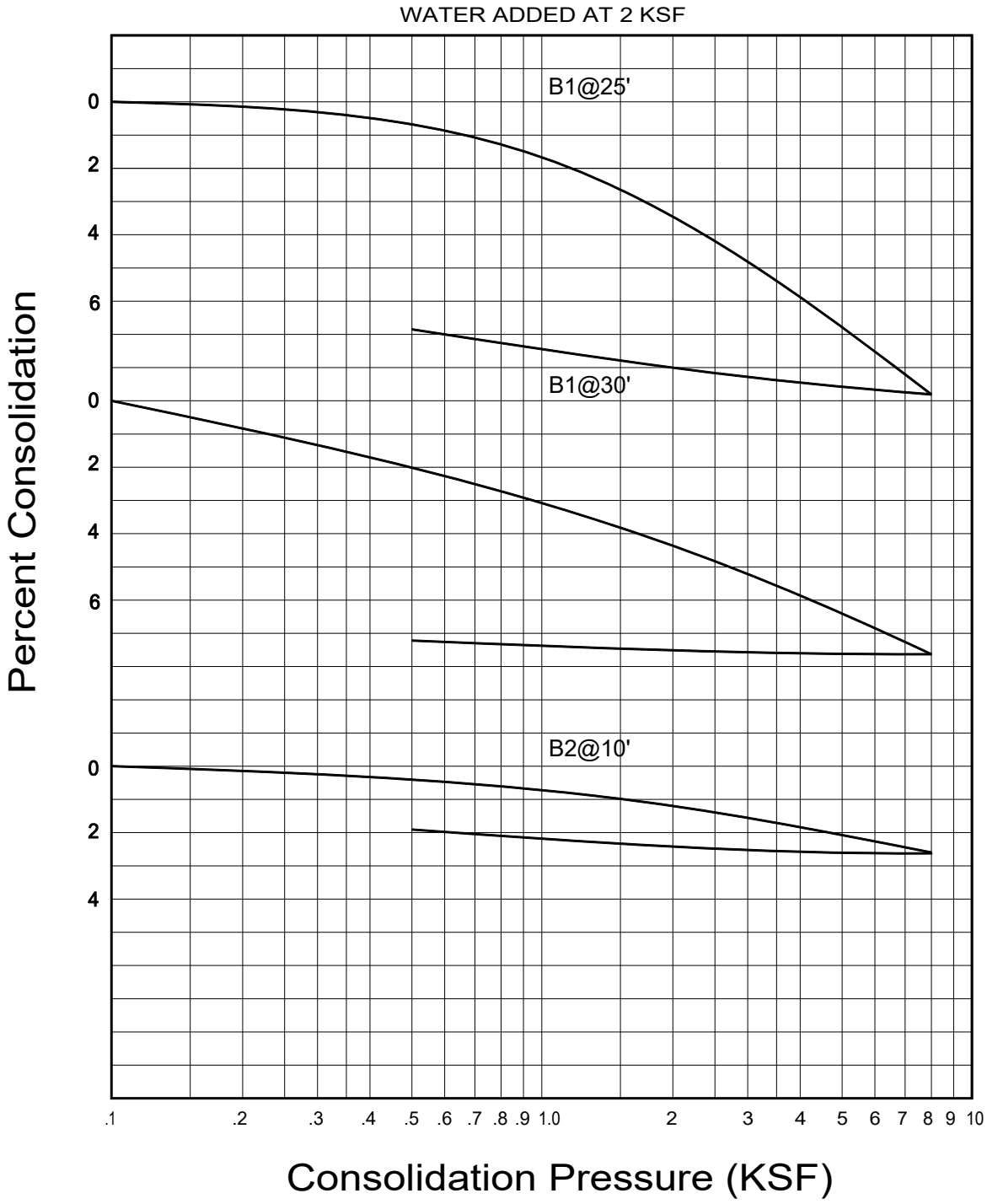
MARCH 2019	PROJECT NO. A9942-88-01	FIG. B3



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CONSOLIDATION TEST RESULTS

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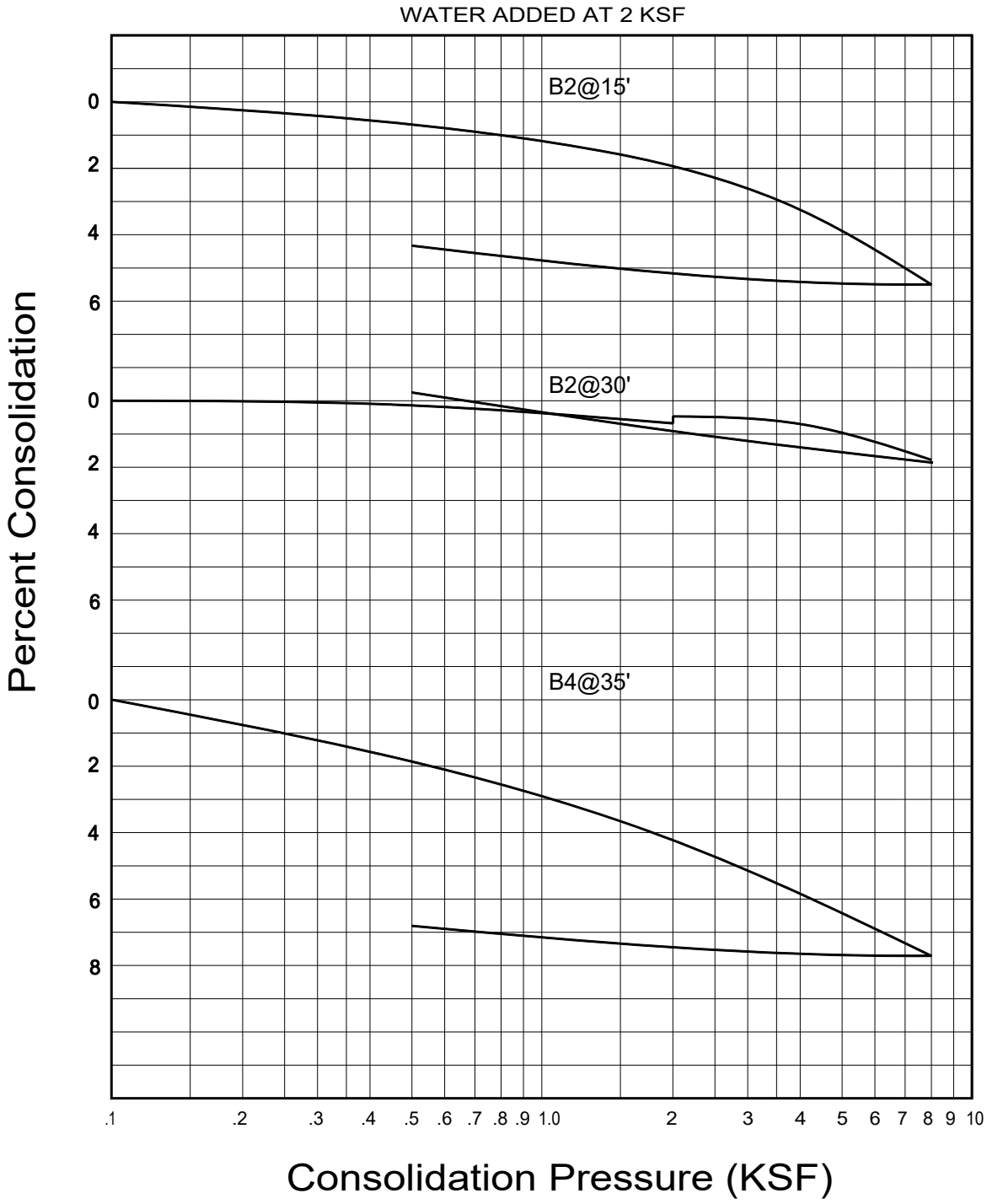
MARCH 2019	PROJECT NO. A9942-88-01	FIG. B4



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CONSOLIDATION TEST RESULTS

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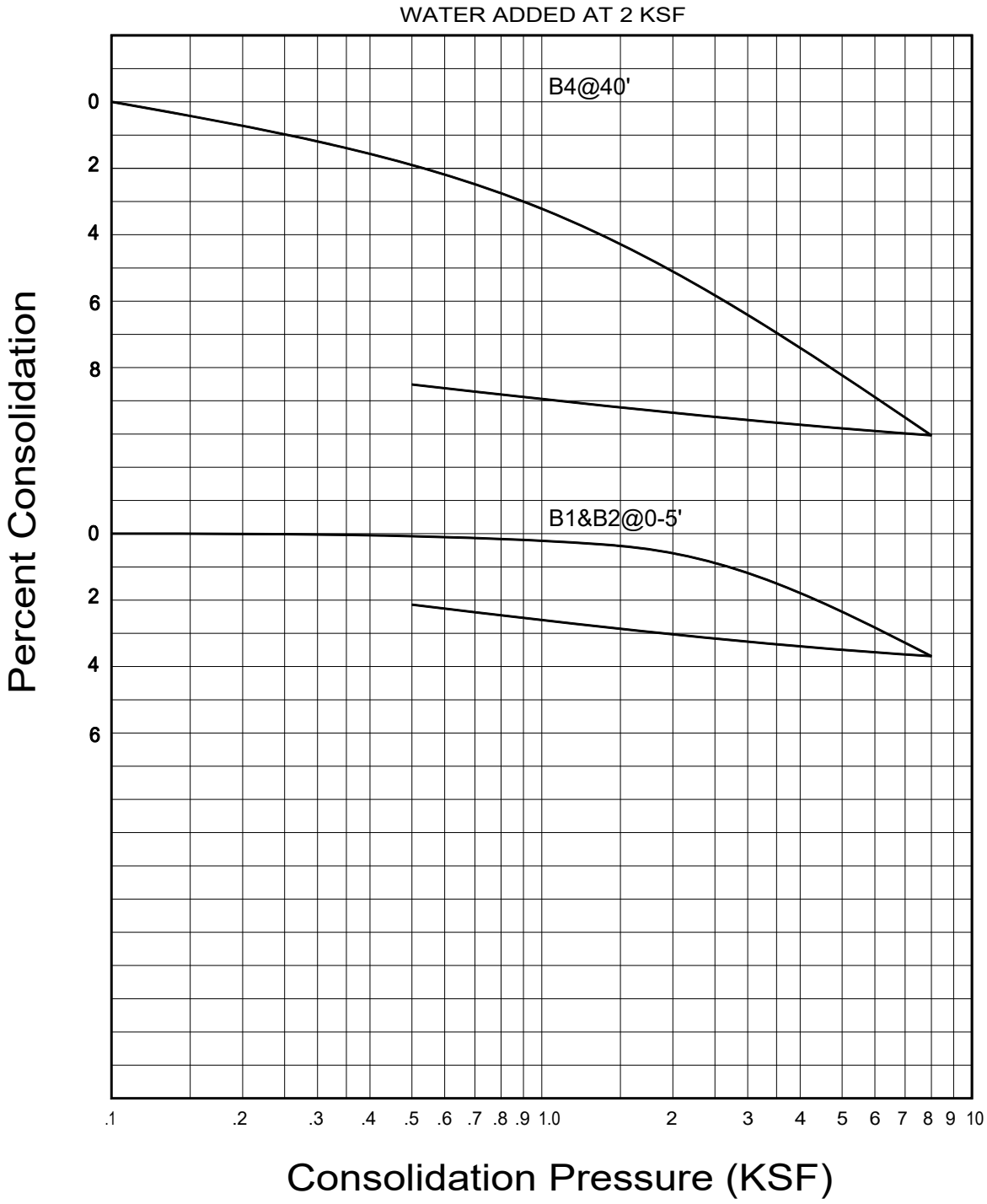
MARCH 2019	PROJECT NO. A9942-88-01	FIG. B5



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CONSOLIDATION TEST RESULTS

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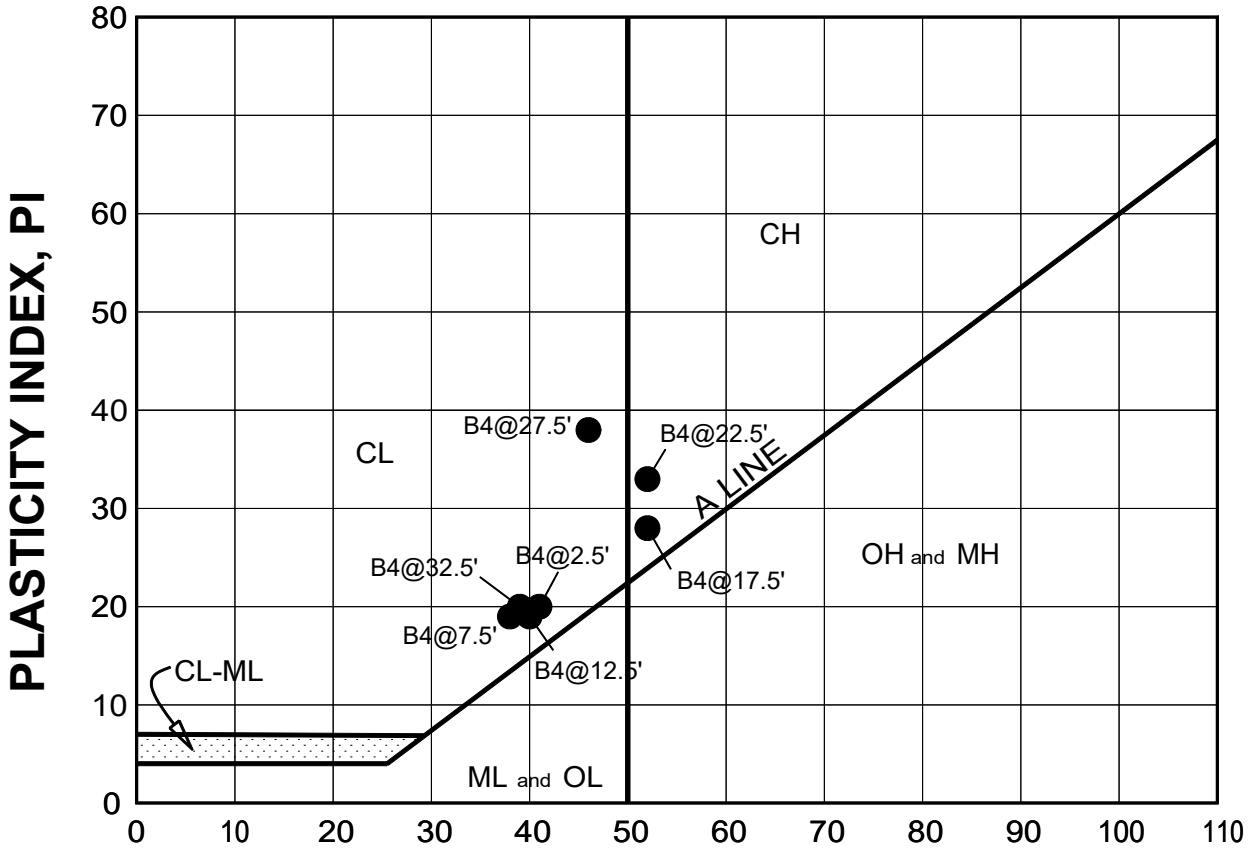
MARCH 2019	PROJECT NO. A9942-88-01	FIG. B6



BORING NUMBER	DEPTH (FEET)	LL	PL	PI	MOISTURE CONTENT AT SATURATION	SOIL BEHAVIOR
B4	**2.5**	**41**	**21**	**20**	**- -**	**CL**
B4	**7.5**	**38**	**19**	**19**	**- -**	**CL**
B4	**12.5**	**40**	**21**	**19**	**- -**	**CL**
B4	**17.5**	**52**	**24**	**28**	**- -**	**CH**
B4	**22.5**	**52**	**19**	**33**	**- -**	**CH**
B4	**27.5**	**46**	**18**	**28**	**- -**	**CL**
B4	**32.5**	**39**	**19**	**20**	**- -**	**CL**

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ATTERBERG LIMITS

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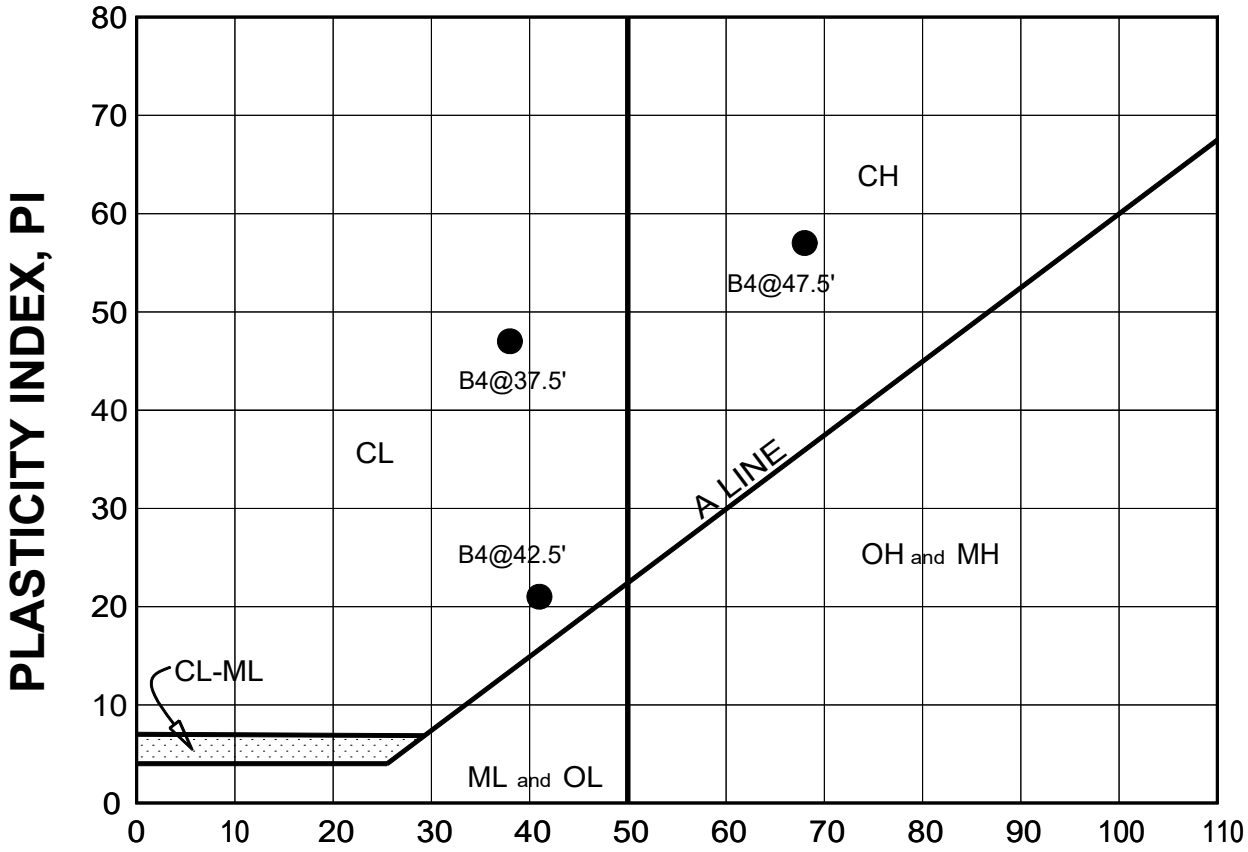
MARCH 2019 | PROJECT NO. A9942-88-01 | FIG. B7



BORING NUMBER	DEPTH (FEET)	LL	PL	PI	MOISTURE CONTENT AT SATURATION	SOIL BEHAVIOR
B4	**37.5**	**38**	**21**	**17**	**- -**	**CL**
B4	**42.5**	**41**	**20**	**21**	**- -**	**CL**
B4	**47.5**	**68**	**21**	**47**	**- -**	**CH**

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ATTERBERG LIMITS

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SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D 4829-11

Sample No.	Moisture Content (%)		Dry Density (pcf)	Expansion Index	*UBC Classification	**CBC Classification
	Before	After				
B1&B2 @ 0-5'	10.0	19.1	109.8	50	Medium	Expansive

* Reference: 1997 Uniform Building Code, Table 18-I-B.

** Reference: 2016 California Building Code, Section 1803.5.3

SUMMARY OF LABORATORY MAXIMUM DENSITY AND AND OPTIMUM MOISTURE CONTENT TEST RESULTS
ASTM D 1557-12

Sample No.	Soil Description	Maximum Dry Density (pcf)	Optimum Moisture (%)
B1&B2 @ 0-5'	Dark Olive Brown Clay	123.0	10.2

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LABORATORY TEST RESULTS

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MARCH 2019 | PROJECT NO. A9942-88-01 | FIG. B9

SUMMARY OF LABORATORY POTENTIAL OF HYDROGEN (pH) AND RESISTIVITY TEST RESULTS CALIFORNIA TEST NO. 643

Sample No.	pH	Resistivity (ohm centimeters)
B1&B2 @ 0-5'	8.03	560 (Severely Corrosive)

SUMMARY OF LABORATORY CHLORIDE CONTENT TEST RESULTS EPA NO. 325.3

Sample No.	Chloride Ion Content (%)
B1&B2 @ 0-5'	0.085

SUMMARY OF LABORATORY WATER SOLUBLE SULFATE TEST RESULTS CALIFORNIA TEST NO. 417

Sample No.	Water Soluble Sulfate (% SO_4)	Sulfate Exposure*
B1&B2 @ 0-5'	0.002	Negligible

* Reference: 2016 California Building Code, Section 1904.3 and ACI 318-14 Table 19.3.1.1

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CORROSIVITY TEST RESULTS

VICTORIA BOULEVARD APARTMENTS
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MARCH 2019 | PROJECT NO. A9942-88-01 | FIG. B10

APPENDIX C

APPENDIX C

CLIQ LIQUEFACTION ANALYSIS REPORT – DE AND MCE OUTPUTS

(CD Only)