Appendix K

Water Quality Management Plan

ESA

PRELIMINARY WATER QUALITY MANAGEMENT PLAN (PWQMP)

EF COSTA MESA CAMPUS

COSTA MESA, California

PREPARED FOR
EF EDUCATION FIRST
2 Education Circle
Cambridge, MA 02141
415.216.8338

PREPARED BY
FUSCOE ENGINEERING, INC.
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PROJECT MANAGER
Mark Nero, PE

DATE PREPARED: April 5, 2019

PROJECT NUMBER: 1793-001-01

full circle thinking®

PRELIMINARY
WATER QUALITY MANAGEMENT PLAN (WQMP)

EF COSTA MESA CAMPUS

3150 Bear Street, Costa Mesa, County of Orange

Tract 3885, 15211, & 17771
APN: 141-521-48 & 141-521-49

Prepared for:

EF EDUCATION FIRST
2 Education Circle
Cambridge, MA 02141
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Prepared by:

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Mark Nero, P.E.

Date Prepared: April 5, 2019

PROJECT OWNER'S CERTIFICATION			
Permit/Application No.:	Pending	**Grading Permit No.:**	Pending
Tract/Parcel Map and Lot(s)No.:	Tract 3885	**Building Permit No.:**	Pending
Address of Project Site and APN:	3150 Bear Street, Costa Mesa, CA 92626 APN: 141-521-48 & 141-521-49		

This Water Quality Management Plan (WQMP) has been prepared for EF EDUCATION FIRST by FUSCOE ENGINEERING, INC. The WQMP is intended to comply with the requirements of the County of Orange NPDES Stormwater Program requiring the preparation of the plan.

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

OWNER:			
Name:	Bev Garth		
Title:	Executive Vice President, EF Properties		
Company:	EF Education First		
Address:	2 Education Circle, Cambridge, MA 02141		
Email:	Bev.Garth@EF.com		
Telephone #:	415.216.8338		
I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein.			
Owner Signature:		**Date:**	

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Appendix D .....BMP Maintenance Supplement / O&M Plan
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Appendix F .....Infiltration Test Results

EXHIBITS & BMP DETAILS (INCLUDED IN SECTION VI)

- Vicinity Map
- Site Plan
- Preliminary WQMP Exhibit
- Typical Cross Sections
- BIO-7 Proprietary Biotreatment BMP Fact Sheet

EDUCATIONAL MATERIALS (INCLUDED IN APPENDIX C)

- The Ocean Begins at Your Front Door
- Recycle at Your Local Used Oil Collection Center (North County)
- Responsible Pest Control
- Tips for Landscaping and Gardening
- Tips for Pool Maintenance
- Tips for Residential Pool, Landscape and Hardscape Drains
- Tips for Protecting Your Watershed
- DF-1 Drainage System Operation & Maintenance
- R-3 Automobile Parking
- R-7 Household Hazardous Waste
- SD-10 Site Design & Landscape Planning
- SD-11 Roof Runoff Controls
- SD-12 Efficient Irrigation
- SD-13 Storm Drain Signage
- SD-32 Trash Storage Areas

SECTION I DISCRETIONARY PERMITS AND WATER QUALITY CONDITIONS

PROJECT INFORMATION			
Permit/Application No.:	Pending	**Grading or Building Permit No.:**	Pending
Address of Project Site (or Tract Map and Lot Number if no address) and APN:	3150 Bear Street, Costa Mesa, CA 92626 APN: 141-521-48 & 141-521-49		
WATER QUALITY CONDITIONS OF APPROVAL OR ISSUANCE			
Discretionary Permit(s):	N/A		
Water Quality Conditions of Approval or Issuance applied to this project: **(Please list verbatim.)**	Pending – to be provided in Final WQMP		
CONCEPTUAL WQMP			
Was a Conceptual Water Quality Management Plan previously approved for this project?	This serves as the conceptual WQMP.		
WATERSHED-BASED PLAN CONDITIONS			
Applicable conditions from watershed - based plans including WIHMPs and TMDLs:	The Santa Ana Watershed does not have an approved WHIMPs or any applicable TMDLs.		

SECTION II PROJECT DESCRIPTION

II.1 PROJECT DESCRIPTION

The proposed EF Costa Mesa Campus project site encompasses approximately 6.19 acres in the City of Costa Mesa. The project site is bounded by the 405 freeway to the north, Bear Street to the west, and existing single family homes to the east and south. A Vicinity Map is included in Section VI.

Under existing conditions, the project site is occupied by the Trinity Broadcast Network and contains an existing 2-story building (approximately 68,000 SF). Adjacent land uses include single family residential to the east and commercial and low density planned development residential to the south.

The table below summarizes the proposed project.

DESCRIPTION OF PROPOSED PROJECT	
Development Category (Model WQMP, Table 7.11-2; or 7.11-3):	8. All significant redevelopment projects, where significant redevelopment is defined as the addition or replacement of 5,000 or more square feet of impervious surface on an already developed site. Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of the facility, or emergency redevelopment activity required to protect public health and safety. If the redevelopment results in the addition or replacement of less than 50 percent of the impervious area on-site and the existing development was not subject to WQMP requirement, the numeric sizing criteria discussed in Section 7.II-2.0 only applies to the addition or replacement area. If the addition or replacement accounts for 50 percent or more of the impervious area, the Project WQMP requirements apply to the entire development.
Project Area (ft^2):	269,549 ft^2 (6.19 acres)
# of Dwelling Units:	627 beds between the three student dormitory buildings.
SIC Code:	N/A
Narrative Project Description:	Under existing conditions, the project site consisted of a two-story office building occupied by Trinity Broadcast Network. The proposed project will consist of an EF International Language Campus and provide students from more than 75 countries with the opportunity to learn English through EF's fully accredited program. At full enrollment, there would be approximately 1,347 international students and approximately 70 faculty, staff, and residential assistants (RA). The renovation of the existing building will include 50 classrooms, student services, cafeteria, and faculty/staff offices. The campus will also consist of three new residential buildings, two two-story, one three-story and the renovated existing building totaling approximately 155,000 SF. The student dormitories will accommodate up to 627 beds.

DESCRIPTION OF PROPOSED PROJECT				
Project Area:	**Pervious Area**	**Pervious Area Percentage**	**Impervious Area**	**Impervious Area Percentage**
Pre-Project Conditions:	2.16 ac	35%	4.03 ac	65%
Post-Project Conditions:	1.73 ac	28%	4.46 ac	72%
Drainage Patterns/ Connections:	Under existing conditions, the project site is fully developed as a commercial complex. Runoff typically flows west and enters an area drain system. Flows traveling via the area drain system will make its way to a city infrastructure located on Bear Street. The largest portion of the sites surface runoff is directed to a curb opening on the north side of the site where it enters the San Diego freeway's concrete channel. From there it will travel north before ultimately draining to the Santa Ana Reach 1 and the Pacific Ocean. Under proposed conditions, runoff will be conveyed in a similar manner to existing drainage conditions. New area drain and storm drain systems will be constructed to convey low flows to one of eight modular wetland systems for water quality treatment. High flows will bypass the modular wetland systems and exit the site onto Bear Street. Treated flows will exit the site west via storm drain system and join an existing city infrastructure located on Bear Street. Other flows may exit the site via concrete spillway and flow north into the freeway right of way, traveling to an existing concrete channel before ultimately draining to the Santa Ana Reach 1 and the Pacific Ocean.			

PROJECT FEATURES	
Building Summary:	TABLE 1 EXISTING AND PROPOSED BUILDINGS

BUILDINGS (NUMBER)	SQUARE FEET
Existing Building	
Main Building (00)	57,700
Proposed Buildings	
Dormitory 1 (01)	49,800
Dormitory 2 (02)	23,000
Dormitory 3 (03	23,000
Subtotal (Proposed)	*100,000*
Total (Existing and Proposed)	155,000

Amenities:	The project site will include a pool, volleyball court, basketball court, and/or soccer field. The project site will also include multiple courtyard and open space areas for designated outdoor communal activities.

PROJECT FEATURES	
Landscaped Areas:	Enhanced common area landscaping surrounding the perimeter of buildings and in courtyards will be provided throughout the project site and will comprise of approximately 28% of the entire site.
Parking Facilities:	A shuttle bus service will be available for students to charter them to and from campus, to the mall, beach, etc. There will also be 102 parking spaces of which 6 will be ADA spaces on campus.
Other Project Features:	The property will include one trash enclosure. It will be located at the northwest corner of the project site. The trash enclosure will be walled on 3 sides with an access gate comprising the remaining side, and covered to preclude precipitation and runoff consistent with local design standards. The site will not have any outdoor storage areas, vehicle/ community car wash racks, or vehicle/equipment wash areas. There is a kitchen/food preparation area located in the west wing of the existing building. A dining hall sits adjacent to the kitchen. A grease interceptor is located onsite to treat sewer water from the kitchen.
Outdoor Activities:	Outdoor areas throughout the site will be used for recreational and open space purposes. The central recreation area will include a pool, basketball and volleyball court, and open lawn areas. All other outdoor areas will be used for walkways, common areas and landscaping, and other recreational purposes.
Materials Stored:	Materials anticipated to be stored on-site include those associated with an institutional campus with dormitories (i.e. cleaning products, storage, etc.); however, no hazardous wastes will be stored on-site. No outdoor storage of materials is anticipated (materials will be stored indoors).
Wastes Generated:	The project is not anticipated to generate any wastes other than landscape clippings, typical trash, debris and refuse from the tenants. 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.

II.2 POTENTIAL STORM WATER POLLUTANTS

The table below, derived from Table 2 of the Countywide Model WQMP Technical Guidance Document (December 2013), summarizes the categories of land use or project features of concern and the general pollutant categories associated with them.

ANTICIPATED & POTENTIAL POLLUTANTS GENERATED BY LAND USE TYPE								
Priority Project Categories and/or Project Features	General Pollutant Categories							
	Suspended Solid/ Sediments	Nutrients	Heavy Metals	Pathogens (Bacteria/ Virus)	Pesticides	Oil & Grease	Toxic Organic Compounds	Trash & Debris
Detached Residential Development	E	E	N	E	E	E	N	E
Attached Residential Development	E	E	N	E	E	E(2)	N	E
Commercial/Industrial Development	E(1)	E(1)	E(5)	E(3)	E(1)	E	E	E
Automotive Repair Shops	N	N	E	N	N	E	E	E
Restaurants	E(1)(2)	E(1)	E(2)	E	E(1)	E	N	E
Hillside Development >5,000 ft^2	E	E	N	E	E	E	N	E
Parking Lots	E	E(1)	E	E(4)	E(1)	E	E	E
Streets, Highways, & Freeways	E	E(1)	E	E(4)	E(1)	E	E	E
Retail Gasoline Outlets	N	N	E	N	N	E	E	E

Notes:
E = expected to be of concern N = not expected to be of concern
(1) Expected pollutant if landscaping exists on-site, otherwise not expected.
(2) Expected pollutant if the project includes uncovered parking areas, otherwise not expected.
(3) Expected pollutant if land use involves food or animal waste products, otherwise not expected.
(4) Bacterial indicators are routinely detected in pavement runoff.
(5) Expected if outdoor storage or metal roofs, otherwise not expected.
Source: County of Orange. (2013, December 20). Technical Guidance Document for the Preparation of Conceptual/ Preliminary and/or Project Water Quality Management Plans (WQMPs). Table 2.1.

Priority Project Categories and/or Features: School Buildings, Parking Lots

POLLUTANTS OF CONCERN		
Pollutant	E = Expected to be of concern N =Not Expected to be of concern	Additional Information and Comments
Suspended Solid/ Sediment	E	
Nutrients	E	
Heavy Metals	E	

POLLUTANTS OF CONCERN		
Pollutant	**E = Expected to be of concern N =Not Expected to be of concern**	**Additional Information and Comments**
Pathogens (Bacteria/Virus)	E	
Pesticides	E	
Oil & Grease	E	
Toxic Organic Compounds	E	
Trash & Debris	E	

II.3 HYDROLOGIC CONDITIONS OF CONCERN

The purpose of this section is to identify any hydrologic conditions of concern (HCOC) with respect to downstream flooding, erosion potential of natural channels downstream, impacts of increased flows on natural habitat, etc. As specified in Section 2.3.3 of the 2011 Model WQMP, projects must identify and mitigate any HCOCs. A HCOC is a combination of upland hydrologic conditions and stream biological and physical conditions that presents a condition of concern for physical and/or biological degradation of streams.

In the North Orange County permit area, HCOCs are considered to exist if any streams located downstream from the project are determined to be potentially susceptible to hydromodification impacts and either of the following conditions exists:

- Post-development runoff volume for the 2-yr, 24-hr storm exceeds the pre-development runoff volume for the 2-yr, 24-hr storm by more than 5 percent

or

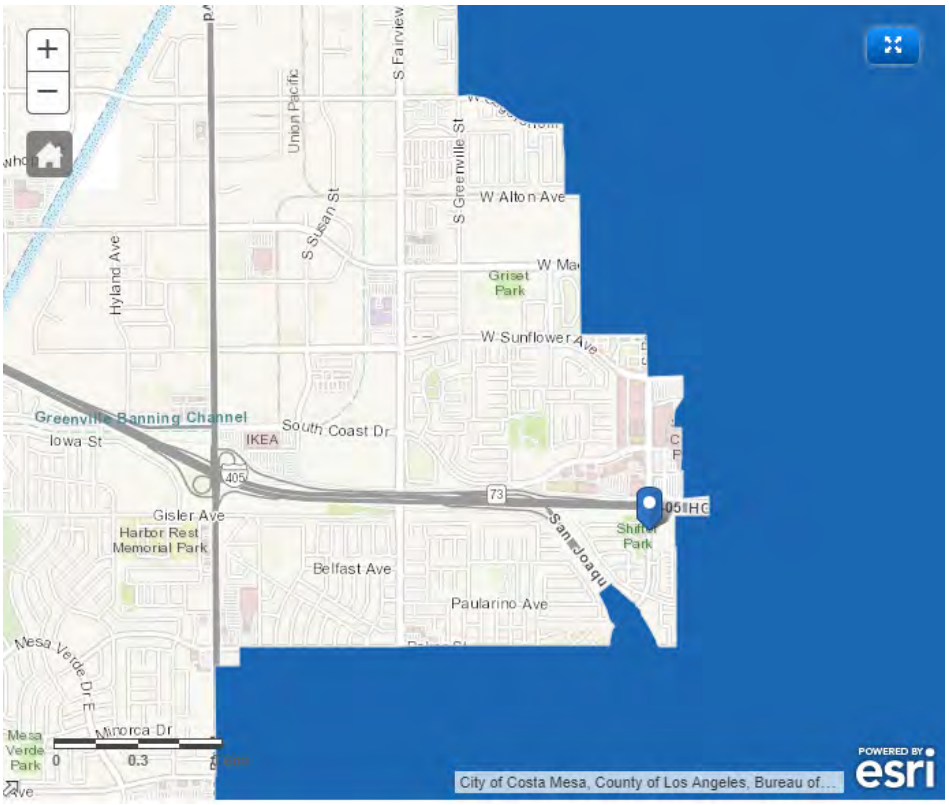
- Time of concentration (Tc) of post-development runoff for the 2-yr, 24-hr storm event exceeds the time of concentration of the pre-development condition for the 2-yr, 24-hr storm event by more than 5 percent.

If these conditions do not exist or streams are not potentially susceptible to hydromodification impacts, an HCOC does not exist and hydromodification does not need to be considered further. In the North Orange County permit area, downstream channels are considered not susceptible to hydromodification, and therefore do not have the potential for a HCOC, if all downstream conveyance channels that will receive runoff from the project are engineered, hardened, and regularly maintained to ensure design flow capacity, and no sensitive habitat areas will be affected.

Is the proposed project potentially susceptible to hydromodification impacts?

☐ **Yes** ☒ **No (show map)**

Based on Figure XVI-3D of the 2013 Technical Guidance Document (TGD), the project site is not located in an area susceptible to hydromodification within the Santa Ana River Watershed.



II.4 POST DEVELOPMENT DRAINAGE CHARACTERISTICS

Under proposed conditions, runoff will be conveyed in a similar manner to existing drainage conditions. New area drain and storm drain systems will be constructed to convey low flows to one of eight modular wetland systems for water quality treatment. High flows will bypass the modular wetland systems and exit the site onto Bear Street. Treated flows will exit the site west via storm drain system and join an existing city infrastructure located on Bear Street. Other flows may exit the site via concrete spillway and flow north into the freeway right of way, traveling to an existing concrete channel before ultimately draining to the Santa Ana Reach 1 and the Pacific Ocean.

II.5 PROPERTY OWNERSHIP/MANAGEMENT

PROPERTY OWNERSHIP/MANAGEMENT	
Public Streets:	City of Costa Mesa
Private Streets:	EF Education First
Landscaped Areas:	EF Education First

PROPERTY OWNERSHIP/MANAGEMENT	
Open Space:	EF Education First
Easements:	City of Costa Mesa
Buildings:	EF Education First
Structural BMPs:	EF Education First

The Owner, EF Education First shall assume all BMP maintenance and inspection responsibilities for the proposed project. Inspection and maintenance responsibilities are outlined in Section V of this report.

SECTION III SITE DESCRIPTION

III.1 PHYSICAL SETTING

Planning Area/ Community Name:	EF Costa Mesa Campus
Address:	3150 Bear St, Costa Mesa, CA 92626
Project Area Description:	The project site is along Bear Street with the 405 freeway bordering the north portion of the site.
Land Use:	Institutional
Zoning:	AP – Administrative and Professional
Acreage:	3.19 acres
Predominant Soil Type:	HSG Type D (refer to TGD Figure XVI-2a in Appendix A)
Impervious Conditions:	Existing Impervious: 65% (35% Pervious) Proposed Impervious: 72% (28% Pervious)

III.2 SITE CHARACTERISTICS

Precipitation Zone:	0.75 in/hr (refer to TGD Figure XVI-1 in Appendix A)
Topography:	The site is relatively flat with gentle sloping from south to north.
Existing Drainage Patterns/ Connections:	Under existing conditions, the project site is fully developed as a commercial complex. Runoff typically flows west and enters an area drain system. Flows traveling via the area drain system will make its way to a city infrastructure located on Bear Street. The largest portion of the sites surface runoff is directed to a curb opening on the north side of the site where it enters the San Diego freeway's concrete channel. From there it will travel north before ultimately draining to the Santa Ana Reach 1 and the Pacific Ocean.
Proposed Drainage Patterns/ Connections:	Under proposed conditions, runoff will be conveyed in a similar manner to existing drainage conditions. New area drain and storm drain systems will be constructed to convey low flows to one of eight modular wetland systems for water quality treatment. High flows will bypass the modular wetland systems and exit the site onto Bear Street. Treated flows will exit the site west via storm drain system and join an existing city infrastructure located on Bear Street. Other flows may exit the site via concrete spillway and flow north into the freeway right of way, traveling to an existing concrete channel before ultimately draining to the Santa Ana Reach 1 and the Pacific Ocean.

Soil Type, Geology, and Infiltration Properties:	A geotechnical study was performed for the site in March 2019 by GMU Geotechnical, Inc. Within the vicinity of the project site, top soils were found one foot in thickness. Young alluvial deposits underlie the fill material and extended to the maximum depth of the exploratory drill holes. The young alluvial deposits consist of moist to wet, firm to stiff clay and silt material, and moist to very moist, medium dense to very dense sand materials.
Hydrogeologic (Groundwater) Conditions:	The project site is located in an area with shallow groundwater levels, approximately between 10-30 feet below bgs as illustrated in the TGD Figure XVI-2e (see Appendix F). During the geotechnical study, moist to wet soils were encountered at depths 18 to 20 feet bgs, and previous data indicates that depth to historic high groundwater within the region of the site is approximately 10 feet bgs.
Geotechnical Conditions (relevant to infiltration):	Three preliminary percolation tests were performed in general conformance with the Santa Ana Regional Water Quality Control Board Technical Guidance Document (TGD). The percolation borings were drilled to a maximum depth of 5 feet below the existing grade using a hollow-stem-auger, truck-mounted drill rig. A safety factor of 2 was used to calculate infiltration rates ranging from 0.01 to 0.02 in/hr. The calculated infiltrate rates do not meet the minimum requirement of 0.3 inches/hour per the TGD manual. On this basis, infiltration of storm water into the site soils is deemed infeasible.
Off-Site Drainage:	The project site does not receive any off-site storm water flows onto the property. Any offsite flows from the west will be diverted via ribbon gutter to avoid co-mingling of project flows.
Utility and Infrastructure Information:	Dry and wet utilities will be incorporated into the proposed project and will tie into existing facilities associated with the existing development.

III.3 WATERSHED DESCRIPTION

Receiving Waters:	Santa Ana River (Reach 1)
303(d) Listed Impairments:	Santa Ana River — bacteria (2010 list). Delisted in 2016.
Applicable TMDLs:	None
Pollutants of Concern for the Project:	▪ Suspended Solids/Sediment ▪ Nutrients ▪ Heavy Metals ▪ Pathogens (Bacteria/Virus) ▪ Pesticides ▪ Oil & Grease ▪ Toxic Organic Compounds ▪ Trash & Debris

Hydrologic Conditions of Concern (HCOCs):	According to Figure XVI-3a within the Technical Guidance Document, the proposed project falls within an area **not** susceptible to hydromodification impacts.
Environmentally Sensitive and Special Biological Significant Areas:	There are no Environmentally Sensitive Areas (ESAs) or Areas of Special Biological Significance (ASBS) within the project site or within the project's vicinity.

SECTION IV BEST MANAGEMENT PRACTICES (BMPs)

IV.1 PROJECT PERFORMANCE CRITERIA

Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis?

☐ **Yes** ☒ **No**

PROJECT PERFORMANCE CRITERIA	
Hydromodification Control Performance Criteria: **(Model WQMP Section 7.II-2.4.2.2)**	If a hydrologic condition of concern (HCOC) exists, priority projects shall implement onsite or regional hydromodification controls such that: ▪ Post-development runoff volume for the two-year frequency storm does not exceed that of the predevelopment condition by more than five percent, and ▪ Time of concentration of post-development runoff for the two-year storm event is not less than that for the predevelopment condition by more than five percent. Where the Project WQMP documents that excess runoff volume from the two-year runoff event cannot feasibly be retained and where in-stream controls cannot be used to otherwise mitigate HCOCs, the project shall implement on-site or regional hydromodification controls to: ▪ Retain the excess volume from the two-year runoff event to the MEP, and ▪ Implement on-site or regional hydromodification controls such that the post-development runoff two-year peak flow rate is no greater than 110 percent of the predevelopment runoff two-year peak flow rate.
LID Performance Criteria: **(Model WQMP Section 7.II-2.4.3)**	Infiltrate, harvest and use, evapotranspire, or biotreat/biofilter, the 85th percentile, 24-hour storm event (Design Capture Volume). LID BMPs must be designed to retain, on-site, (infiltrate, harvest and use, or evapotranspire) storm water runoff up to 80 percent average annual capture efficiency.
Treatment Control BMP Performance Criteria: **(Model WQMP Section 7.II-3.2.2)**	If it is not feasible to meet LID performance criteria through retention and/or biotreatment provided on-site or at a sub-regional/regional scale, then treatment control BMPs shall be provided on-site or offsite prior to discharge to waters of the US. Sizing of treatment control BMP(s) shall be based on either the unmet volume after claiming applicable water quality credits, if appropriate.

PROJECT PERFORMANCE CRITERIA	
LID Design Storm Capture Volume:	DCV = C × d × A × 43560 sf/ac × 1/12 in/ft Where: DCV = design storm capture volume, cu-ft C = runoff coefficient = (0.75 × imp + 0.15) Imp = impervious fraction of drainage area (ranges from 0 to 1) d = storm depth (inches) A = tributary area (acres) Imp = 72% d = 0.75 inches A = 6.19 acres *DCV* = *(0.75 x* 0.72 *+0.15) x* 0.75 *inches x* 6.19 *ac x 43560 sf/ac x 1/12 in/ft* = 11,624.3 *Refer to Section IV.2.2 for specific Drainage Manage Area (DMA) breakdown and Appendix A for detailed calculations (Worksheet B).*

IV.2 SITE DESIGN AND DRAINAGE PLAN

The following section describes the site design BMPs used in this project and the methods used to incorporate them. Careful consideration of site design is a critical first step in storm water pollution prevention from new developments and redevelopments.

IV.2.1 Site Design BMPs

Minimize Impervious Area

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

Maximize Natural Infiltration Capacity

Infiltration is not recommended for the project site due to proximity to groundwater. Refer to Section IV.3.2 for details.

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 units for water quality treatment via biotreatment.

Disconnect Impervious Areas

Landscaping will be provided adjacent to sidewalks and between the proposed buildings. Low-flows and first-flush runoff will drain to modular wetland units for water quality treatment via biotreatment. Refer to Section IV.3.4 for further details.

Protect Existing Vegetation and Sensitive Areas, and Revegetate Disturbed Areas

There are no existing vegetated or sensitive areas to preserve on the project site. All disturbed areas will either be paved or landscaped.

Xeriscape 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.

IV.2.2 Drainage Management Areas

In accordance with the MS4 permit and the 2011 Model WQMP, 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. DMAs have been delineated based on the proposed site grading patterns, drainage patterns, storm drain and catch basin locations.

The design capture volumes (DCV) and treatment flow rates (Q_{Design}) for each DMA are summarized in the table below. These have been derived utilizing the "Simple Method" in accordance with the TGD Section III.1.1. Actual BMP sizing requirements, including 80 percent capture design volumes, flow rates, depths, and other design details for the specific BMPs proposed are provided in Section IV.3.4 below. Locations of DMAs and associated LID and treatment BMPs are identified on the exhibits in Section VI. Additional calculations and TGD Worksheets are provided in Appendix A.

DRAINAGE MANAGEMENT AREAS (DMAs)								
DMA/ Drainage Area ID(1)	Tributary Drainage Area (ft^2)	Tributary Drainage Area (ac)	% Imp.	Design Storm Depth(2) (in)	Estimated Tc (min)	Rainfall Intensity(3) (in/hr)	Simple Method DCV(4) (ft^3)	Q_{Design} (5) (cfs)
DMA A	69,696	1.6	70	0.75	5	0.26	2,940	0.281
DMA B	26,136	0.6	73	0.75	5	0.26	1,140	0.109
DMA C	65,340	1.5	73	0.75	5	0.26	2,851	0.72
DMA D	108,900	2.5	73	0.75	5	0.26	4,751	0.454
TOTAL	269,549	6.19	72	0.75	5	0.26	11,624	1.110

Notes:
1. Refer to exhibits in Section VI for locations of each DMA.
2. Per Figure XVI-1 of the Technical Guidance Document, dated December 20, 2013. See also Appendix A.
3. Per Figure III.4 of the Technical Guidance Document, dated December 20, 2013. See also Appendix A.
4. Per Section III.1.1 of the Technical Guidance Document.
5. Per Section III.3.3 and Worksheet D of the Technical Guidance Document.

IV.3 LID BMP SELECTION AND PROJECT CONFORMANCE ANALYSIS

Low Impact Development (LID) BMPs are required in addition to site design measures and source controls to reduce pollutants in storm water discharges. LID BMPs are engineered facilities that are designed to retain or biotreat runoff on the project site. The 4th Term MS4 Storm Water Permit (Order R8-2009-0030) requires the evaluation and use of LID features using the following hierarchy of treatment: infiltration, evapotranspiration, harvest/reuse, and biotreatment. The following sections summarize the LID BMPs proposed for the project in accordance with the permit hierarchy and performance criteria outlined in Section IV.1.

IV.3.1 Hydrologic Source Controls (HSCs)

Hydrologic source controls (HSCs) can be considered to be a hybrid between site design practices and LID BMPs. HSCs are distinguished from site design BMPs in that they do not reduce the tributary area or reduce the imperviousness of a drainage area; rather they reduce the runoff volume that would result from a drainage area with a given imperviousness compared to what would result if HSCs were not used.

HYDROLOGIC SOURCE CONTROLS		
ID	Name	Included?
HSC-1	Localized on-lot infiltration	☐
HSC-2	Impervious area dispersion (e.g. roof top disconnection)	☐
HSC-3	Street trees (canopy interception)	☐
HSC-4	Residential rain barrels (not actively managed)	☐
HSC-5	Green roofs/Brown roofs	☐
HSC-6	Blue roofs	☐
HSC-7	Impervious area reduction (e.g. permeable pavers, site design)	☐

HSCs were not incorporated into the project's design at this stage in the project's development. Any HSC's will be accounted for during final design and the cumulative volume of the HSC's will be subtracted from the required treatment volume in the Final WQMP.

IV.3.2 Infiltration BMPs

Infiltration BMPs are LID BMPs that capture, store and infiltrate storm water runoff. These BMPs are engineered to store a specified volume of water and have no design surface discharge (underdrain or outlet structure) until this volume is exceeded. Examples of infiltration BMPs include infiltration trenches, bioretention without underdrains, drywells, permeable pavement, and underground infiltration galleries.

INFILTRATION		
ID	**Name**	**Included?**
INF-3 INF-4	Bioretention Without Underdrains	☐
	Rain Gardens	☐
	Porous Landscaping	☐
	Infiltration Planters	☐
	Retention Swales	☐
INF-2	Infiltration Trenches	☐
INF-1	Infiltration Basins	☐
INF-5	Drywells	☐
INF-7	Subsurface Infiltration Galleries	☐
--	French Drains	☐
INF-6	Permeable Asphalt	☐
	Permeable Concrete	☐
	Permeable Concrete Pavers	☐
	Other:	☐

No infiltration BMPs are proposed within the redevelopment project. As discussed in Section III.2, the project site had field infiltration rates ranging between 0.01 in/hr and 0.02 in/hr, which is less than the minimum requirement for feasibility of 0.3 in/hr, infiltration is considered infeasible on-site. Further, the site is located in an area with historical high groundwater. Therefore, direct or concentrated infiltration of runoff is not considered feasible for the project. See also Appendices A and F for further details.

IV.3.3 Evapotranspiration & Rainwater Harvesting BMPs

Evapotranspiration (ET) BMPs are a class of retention BMPs that discharges stored volume predominately to ET, though some infiltration may occur. ET includes both evaporation and transpiration, and ET BMPs may incorporate one or more of these processes. BMPs must be designed to achieve the maximum feasible ET, where required to demonstrate that the maximum amount of water has been retained on-site. Since ET is not the sole process in these BMPs, specific design and sizing criteria have not been developed for ET-based BMPs.

EVAPOTRANSPIRATION		
ID	**Name**	**Included?**
--	HSCs, *see Section IV.3.1*	☐
--	Surface-based infiltration BMPs	☐
--	Biotreatment BMPs, see *Section VI.3.4*	☐
	Other:	☐

Bioretention BMPs are proposed which utilize evapotranspiration as physical process for runoff volume reduction. Bioretention BMPs are described further in Section IV.3.4.

Harvest and use (aka. Rainwater Harvesting) BMPs are LID BMPs that capture and store storm water runoff for later use. These BMPs are engineered to store a specified volume of water and have no design surface discharge until this volume is exceeded. Harvest and use BMPs include both above-ground and below-ground cisterns. Examples of uses for harvested water include irrigation, toilet and urinal flushing, vehicle washing, evaporative cooling, industrial processes and other non-potable uses.

HARVEST & REUSE / RAINWATER HARVESTING		
ID	**Name**	**Included?**
HU-1	Above-ground cisterns and basins	☐
HU-2	Underground detention	☐
--	Other:	☐

In order to quantify harvested water demand for the common areas of the project, the Modified Estimated Applied Water Use (EAWU) method was used, consistent with Appendix X of the Model WQMP's Technical Guidance Document (TGD), dated December 20, 2013.

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:

$$Modified\ EAWU = \frac{(ETo\text{wet} \times KL \times LA \times 0.015)}{IE}$$

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 X.2 of the TGD
K_L = landscape coefficient (Table X.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 system must be designed with a storage volume equal to the DCV from the tributary area and achieve more than 40% capture. The system must also be able to drawdown in 30 days to meet the 40% capture value. In addition, Table X.6 of the Technical Guidance Document sets forth the demand thresholds for minimum partial capture.

TABLE X.6: HARVESTED WATER DEMAND THRESHOLDS FOR MINIMUM PARTIAL CAPTURE	
Design Capture Storm Depth, inches	Wet Season Demand Required for Minimum Partial Capture, gpd per impervious acre
0.60	490
0.65	530
0.70	570
0.75	610
0.80	650
0.85	690
0.90	730
0.95	770
1.00	810

The following table summarizes the estimated applied water use for the common area landscaping of the project.

ESTIMATED APPLIED WATER USE (EAWU) FOR COMMON AREA LANDSCAPING									
Landscape Type	Total Area (ac)	% Impervious	Impervious Tributary (ac)	Irrigated LS Area (ac)	ETo_{Wet} (1) (in/mo)	K_L (2)	Modified EAWU (gpd)	Modified EAWU per impervious acre (gpd/ac)	Minimum Capture Threshold (3) (gpd/ac)
Blended Use	6.19	72	4.46	1.73	3	0.55	2,076	466	610
Design Capture Volume (gal)				86,950	Drawdown (days)				42

ESTIMATED APPLIED WATER USE (EAWU) FOR COMMON AREA LANDSCAPING									
Landscape Type	Total Area (ac)	% Impervious	Impervious Tributary (ac)	Irrigated LS Area (ac)	ETo_{Wet} (1) (in/mo)	K_L (2)	Modified EAWU (gpd)	Modified EAWU per impervious acre (gpd/ac)	Minimum Capture Threshold (3) (gpd/ac)

Notes:
1 Per Table X.2 for Santa Ana Region (similar climate type), Model WQMP Technical Guidance Document, dated December 20, 2013.
2 Per Table X.4 of the Model WQMP Technical Guidance Document, dated December 20, 2013.
3 Per Table X.6 of Model WQMP Technical Guidance Document, dated December 20, 2013.

As shown above, the project site does not have sufficient water demand during the wet season to support harvest and reuse. The project does not meet the minimum capture threshold of 610 gallons per day/acre with its Modified EAWU or estimated daily average water usage during the wet season. Therefore, the DCV will not be fully utilized and emptied for the next storm event. Drawdown of the DCV is anticipated to take approximately 42 days by the landscape's water demand usage, which is greater than the maximum drawdown time of 30 days

IV.3.4 Biotreatment BMPs

Biotreatment BMPs are a broad class of LID BMPs that reduce storm water volume to the maximum extent practicable, treat storm water using a suite of treatment mechanisms characteristic of biologically active systems, and discharge water to the downstream storm drain system or directly to receiving waters. Treatment mechanisms include media filtration (though biologically-active media), vegetative filtration (straining, sedimentation, interception, and stabilization of particles resulting from shallow flow through vegetation), general sorption processes (i.e., absorption, adsorption, ion-exchange, precipitation, surface complexation), biologically-mediated transformations, and other processes to address both suspended and dissolved constituents. Examples of biotreatment BMPs include bioretention with underdrains, vegetated swales, constructed wetlands, and proprietary biotreatment systems.

BIOTREATMENT		
ID	Name	Included?
BIO-1	Bioretention with underdrains	☐
	Storm Water planter boxes with underdrains	☐
	Rain gardens with underdrains	☐
BIO-5	Constructed wetlands	☐
BIO-2	Vegetated swales	☐
BIO-3	Vegetated filter strips	☐
BIO-7	Proprietary vegetated biotreatment systems	☒

BIOTREATMENT		
ID	**Name**	**Included?**
BIO-4	Wet extended detention basin	☐
BIO-6	Dry extended detention basins	☐
--	Other:	☐

Since both infiltration and harvest and reuse are considered infeasible, biotreatment BMPs will be utilized on-site for water quality treatment. The project will implement eight proprietary biotreatment systems 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 Table 4.2 of the

Technical Guidance Document and testing data provided by the manufacturer. Additional details for the Modular Wetland System are included in Section VI 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.

In accordance with the Model WQMP and TGD, the bioretention/biotreatment BMPs will be sized to treat runoff from the Design Capture Storm (85th percentile, 24-hour). Since Modular Wetlands are sized based on flow rate, they were sized utilizing the methodology for flow based BMPs (TGD Section III.1.2 and Worksheet D). Locations and tributary drainage areas are shown on the WQMP Exhibit included in Section VI. BMP details are also included in Section VI. Detailed calculations and associated TGD Worksheets are included in Appendix A. Operation and maintenance details are included in Section V and Appendix D (Operation and Maintenance Plan).

	MODULAR WETLAND DESIGN SUMMARY					
DMA(1)(2)	**Total Drainage Area (ac)**	**% Imp.**	**Q_{Design}**(3) **(cfs)**	**Sizes / Models**(4)	**Number of Units Needed**	**Total Treatment Capacity**(5) **(cfs)**
DMA A	1.6	70%	0.281	MWS-L-4-13	2	0.288
DMA B	0.6	73%	0.109	MWS-L-4-6	2	0.146

DMA C	1.5	73%	0.272	MWS-L-4-13	2	0.288
DMA D	2.5	73%	0.454	MWS-L-8-8	2	0.462

Notes:
(1) See also Section IV.2.2.
(2) Refer to WQMP Exhibit in Section VI for locations of each drainage area and BMP.
(3) Detailed calculations and worksheets are included in Appendix A.
(4) Unit details and specifications are included in Section VI.
(5) Treatment capacities of each unit are based on wetland media design loading rate (controlled by downstream orifice) and perimeter surface area of wetland media provided. Individual unit sizing calculations provided by the manufacturer are included on each cut sheet/detail included in Section VI.

In the preliminary design, eight Modular Wetland System (MWS) units are proposed for the project site to treat water quality volumes. Runoff from DMA A will be treated with two MWS-L-4-13 units for a total treatment capacity of 0.288 cfs, runoff from DMA B will be treated with two MWS-L-4-6 units for a total treatment capacity of 0.146 cfs, runoff from DMA C will be treated with two MWS-L-4-13 units for a total treatment capacity of 0.288 cfs, and runoff from DMA D will be treated with two MWS-L-8-8 units for a total treatment capacity of 0.462 cfs. Refer to the WQMP exhibit in Section VI for proposed locations of MWS units. As final grading and storm drain design progresses, any changes to drainage management areas, storm drain connections, and MWS unit count and sizing will be accounted for in the Final WQMP.

IV.3.5 Hydromodification Control BMPs

Not applicable. Refer to Section II.3 for further information.

IV.3.6 Regional/Sub-Regional LID BMPs

Not applicable. LID BMPs (biotreatment) will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.

IV.3.7 Treatment Control BMPs

Treatment control BMPs can only be considered if the project conformance analysis indicates that it is not feasible to retain the full design capture volume with LID BMPs.

TREATMENT CONTROL BMPs		
ID	**Name**	**Included?**
TRT-1	Sand Filters	☐
TRT-2	Cartridge Media Filter	☐
PRE-1	Hydrodynamic Separation Device	☐
PRE-2	Catch Basin Insert	☐
	Other:	☐

Not applicable. LID BMPs (biotreatment) will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.

IV.3.8 Non-Structural 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	Included?	Not Applicable?	If Not Applicable, Provide Brief Reason
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Not applicable – no hazardous materials.
N6	Local Water Quality Permit Compliance	☐	☒	The City of Costa Mesa does not issue water quality permits.
N7	Spill Contingency Plan	☐	☒	Not applicable – no hazardous materials.
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tanks are proposed.
N9	Hazardous Materials Disclosure Compliance	☐	☒	Hazardous materials will not be stored on-site.
N10	Uniform Fire Code Implementation	☐	☒	Not applicable – no hazardous materials.
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	No loading docks are proposed.
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	No retail gasoline outlets are 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 VII 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.cabmphandbooks.com/).

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 are provided in Section V of this WQMP, and the O&M Plan is included in Appendix D.

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 and parking lots within the project on a quarterly basis.

IV 3.9 Structural 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.

STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Included?	Not Applicable?	If Not Applicable, Provide Brief Reason
S1 SD-13	Provide storm drain system stenciling and signage	☒	☐	
S2 SD-34	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	No outdoor storage proposed.
S3 SD-32	Design and construct trash and waste storage areas to reduce pollution introduction	☒	☐	
S4 SD-12	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 project site.
S6 SD-31	Properly Design: Dock areas	☐	☒	No loading docks proposed.
S7 SD-31	Properly Design: Maintenance bays	☐	☒	No maintenance bays proposed.
S8 SD-33	Properly Design: Vehicle wash areas	☐	☒	No wash racks proposed.
S9 SD-36	Properly Design: Outdoor processing areas	☐	☒	No outdoor storage proposed.
S10	Properly Design: Equipment wash areas	☐	☒	No washing proposed.
S11 SD-30	Properly Design: Fueling areas	☐	☒	No fueling areas proposed.
S12 SD-10	Properly Design: Hillside landscaping	☐	☒	No hillsides on project site.

STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Included?	Not Applicable?	If Not Applicable, Provide Brief Reason
S13	Properly Design: Wash water control for food preparation areas	☐	☒	No food prep proposed.
S14	Properly Design: Community car wash racks	☐	☒	No car wash racks proposed.

S1/SD-13, 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.

S3/SD-32, Design and construct trash and waste storage areas to reduce pollution introduction

All trash and waste shall be stored in containers that have lids or tarps to minimize direct precipitation into the containers. One trash enclosure will be located on the north west side of the property. The trash storage areas will be designed to City standards, and will be walled, roofed, have gates and proper drainage per City standards.

S4/SD-12, 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.

IV.4 ALTERNATIVE COMPLIANCE PLAN

IV.4.1 Water Quality Credits

Local jurisdictions may develop a water quality credit program that applies to certain types of development projects after they first evaluate the feasibility of meeting LID requirements on-site. If it is not feasible to meet the requirements for on-site LID, project proponents for specific project types can apply credits that would reduce project obligations for selecting and sizing other treatment BMPs or participating in other alternative programs.

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

Not applicable. Water quality credits will not be applied for the project. LID BMPs will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.

IV.4.2 Alternative Compliance Plan Information

Not applicable. LID BMPs (biotreatment) will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.

SECTION V INSPECTION/MAINTENANCE RESPONSIBILITY FOR BMPs

It has been determined that EF Education First shall assume all BMP inspection and maintenance responsibilities for the EF Costa Mesa Campus project.

Contact Name:	Bev Garth
Title:	Executive Vice President, EF Properties
Company:	EF Education First
Address:	2 Education Circle, Cambridge, MA 02141
Phone:	415.216.8338
Email:	Bev.Garth@EF.com

Should the maintenance responsibility be transferred at any time during the operational life of EF Costa Mesa Campus, such as when an HOA or POA is formed for a project, a formal notice of transfer shall be submitted to the City of Costa Mesa at the time responsibility of the property subject to this WQMP is transferred. The transfer of responsibility shall be incorporated into this WQMP as an amendment.

The Owner shall verify BMP implementation and ongoing maintenance through inspection, self-certification, survey, or other equally effective measure. The certification shall verify that, at a minimum, the inspection and maintenance of all structural BMPs including inspection and performance of any required maintenance in the late summer / early fall, prior to the start of the rainy season. A form that may be used to record implementation, maintenance, and inspection of BMPs is included in Appendix D.

The City of Costa Mesa may conduct verifications to assure that implementation and appropriate maintenance of structural and non-structural BMPs prescribed within this WQMP is taking place at the project site. The Owner shall retain operations, inspections and maintenance records of these BMPs and they will be made available to the City or County upon request. All records must be maintained for at least five (5) years after the recorded inspection date for the lifetime of the project.

Long-term funding for BMP maintenance will be provided by EF Education First.

The Operations and Maintenance (O&M) Plan can be found in Appendix D.

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
BIOTREATMENT BMPs				
BIO-7	Proprietary Biotreatment: Modular Wetland Systems (MWS)	The Modular Wetland unit shall be maintained in accordance with manufacturer's specifications. The system shall be inspected at a minimum of once every six months, prior to the start of the rainy season (October 1) each year, and after major storm events. Typical maintenance includes removing trash & debris from the catch basin screening filter (by hand), removal of sediment and solids in the settlement chamber (vacuum truck), replacement of the BioMediaGREEN™ filter cartridge, and replacement of the BioMediaGREEN™ drain down filter (if equipped). In addition, plants within the wetland chamber will require trimming as needed in conjunction with routine landscape maintenance activities. No fertilizer shall be used in this chamber. Wetland chamber should be inspected during rain events to verify flow through the system. If little to no flow is observed from the lower valve or orifice plate, the wetland media may require replacement. If prior treatment stages are properly maintained, the life of the wetland media can be up to 20 years.	2x per year	Owner

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
NON-STRUCTURAL SOURCE CONTROL BMPs				
N1	Education for Property Owners, Tenants and Occupants	Educational materials will be provided to tenants or employees annually. Materials to be distributed are found in Appendix C of this WQMP. Tenants will be provided these materials by the Property Management prior to occupancy and annually thereafter.	Upon first occupancy, Annually thereafter	Owner
N2	Activity Restrictions	The Owner will prescribe activity restrictions to protect surface water quality, through lease terms or other equally effective measure, for the property. Restrictions include, but are not limited to, prohibiting vehicle maintenance, vehicle washing, and washing of impervious areas.	Ongoing	Owner
N3	Common Area Landscape Management	Maintenance shall be consistent with City requirements. Fertilizer and/or pesticide usage shall be consistent with City Guidelines for Use of Fertilizers (LIP Exhibit A-5.1V) as well as local requirements. Maintenance includes mowing, weeding, and debris removal on a weekly basis. Trimming, replanting, and replacement of mulch shall be performed on an as-needed basis to prevent exposure of erodible surfaces. Trimmings, clippings, and other landscape wastes shall be properly disposed of in accordance with local regulations. Materials temporarily stockpiled during maintenance activities shall be placed away from water courses and storm drain inlets.	Monthly	Owner

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
N4	BMP Maintenance	Maintenance of structural BMPs implemented at the project site shall be performed at the frequency prescribed in this WQMP. Records of inspections and BMP maintenance shall be kept by the Owner and shall be available for review upon request.	Ongoing	Owner
N5	Title 22 CCR Compliance (How development will comply)	Not Applicable		
N6	Local Industrial Permit Compliance	Not Applicable		
N7	Spill Contingency Plan	Not Applicable		
N8	Underground Storage Tank Compliance	Not Applicable		
N9	Hazardous Materials Disclosure Compliance	Not Applicable		
N10	Uniform Fire Code Implementation	Not Applicable		
N11	Common Area Litter Control	Litter patrol, violations investigations, reporting and other litter control activities shall be performed on a weekly basis and in conjunction with routine maintenance activities.	Weekly	Owner
N12	Employee Training	Educate all new employees/ managers on storm water pollution prevention, particularly good housekeeping practices, prior to the start of the rainy season (October 1). Refresher courses shall be conducted at a minimum annually, and more frequently if necessary.	Annually	Owner
N13	Housekeeping of Loading Docks	Not Applicable		

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
N14	Common Area Catch Basin Inspection	Catch basin inlets and other drainage facilities shall be inspected after each storm event and once per year. Inlets and other facilities shall be cleaned prior to the rainy season, by October 1 each year.	Annually	Owner
N15	Street Sweeping Private Streets and Parking Lots	Private streets, drive aisles & any exposed parking areas must be swept at least weekly, including prior to the start of the rainy season (October 1).	Weekly	Owner
N16	Retail Gasoline Outlets	Not Applicable		
STRUCTURAL SOURCE CONTROL BMPs				
S1 SD-13	Provide storm drain system stenciling and signage	Storm drain stencils shall be inspected for legibility, at minimum, once prior to the storm season, no later than October 1 each year. Those determined to be illegible will be re-stenciled as soon as possible.	Annually	Owner
S2 SD-34	Design and construct outdoor material storage areas to reduce pollution introduction	Not Applicable		
S3 SD-32	Design and construct trash and waste storage areas to reduce pollution introduction	Sweep trash area at least once per week and before October 1st each year. Maintain area clean of trash and debris at all times.	Weekly	Owner
S4 SD-12	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	Inspect, test and adjust irrigation system to eliminate overspray to hardscape areas, ensure timing and cycle lengths are correct.	Weekly Visual inspection testing 2x per year	Owner
S5	Protect slopes and channels and provide energy dissipation	Not Applicable		
S6 SD-31	Properly Design: Dock areas	Not Applicable		

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
S7 SD-31	Properly Design: Maintenance bays	Not Applicable		
S8 SD-33	Properly Design: Vehicle wash areas	Not Applicable		
S9 SD-36	Properly Design: Outdoor processing areas	Not Applicable		
S10	Properly Design: Equipment wash areas	Not Applicable		
S11 SD-30	Properly Design: Fueling areas	Not Applicable		
S12 SD-10	Properly Design: Hillside landscaping	Not Applicable		
S13	Properly Design: Wash water control for food preparation areas	Not Applicable		
S14	Properly Design: Community car wash racks	Not Applicable		

Any waste generated from maintenance activities will be disposed of properly. Wash water and other waste from maintenance activities is not to be discharged or disposed of into the storm drain system. Clippings from landscape maintenance (i.e. prunings) will be collected and disposed of properly off-site, and will not be washed into the streets, local area drains/conveyances, or catch basin inlets.

SECTION VI SITE PLAN AND DRAINAGE PLAN

The exhibits provided in this section are to illustrate the post construction BMPs prescribed within this WQMP. Drainage flow information of the proposed project, such as general surface flow lines, concrete or other surface drainage conveyances, and storm drain facilities are also depicted. All structural source control and treatment control BMPs are shown as well.

EXHIBITS

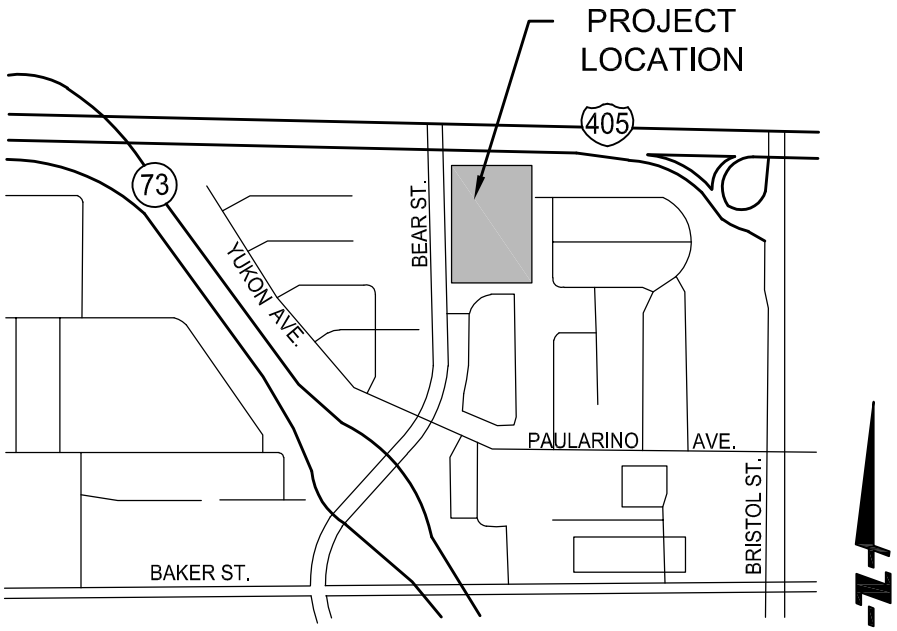
- Vicinity Map
- Site Plan
- Preliminary WQMP Exhibit

BMP DETAILS & FACT SHEETS

- Modular Wetland Details
- BIO-7 Proprietary Biotreatment BMP Fact Sheet

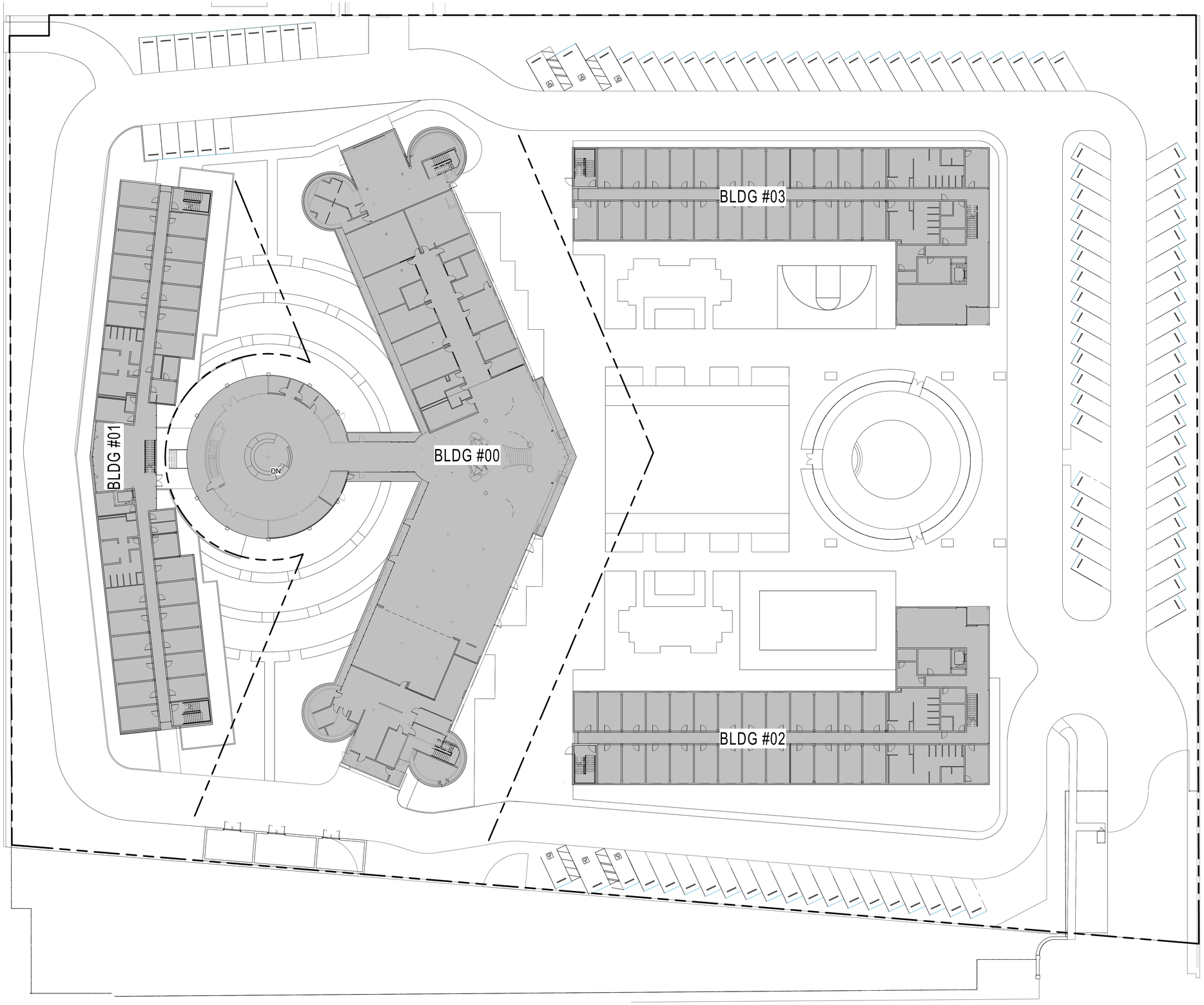
VICINITY MAP

EF EDUCATION FIRST, COSTA MESA CAMPUS
3150 BEAR STREET, COSTA MESA, CA



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

F:\PROJECTS\1793\001\EXHIBITS\1793-001XH01- VICINITY MAP.DWG (01-11-2019 4:36:47PM) Plotted by: Gabreelle Gonzalez



OVERALL SITE - GROUND LEVEL 01

SCALE: 1" = 20'-0"

SHEET NOTES

GENERAL NOTES

KEY PLAN

EFEKTA GROUP, INC.
3150 Bear St.
Costa Mesa, CA 92626

Gensler
500 South Figueroa Street
Los Angeles, California 90071
United States
Tel 213.327.3600
Fax 213.327.3601

Date	Description

Seal / Signature

NOT FOR CONSTRUCTION

Project Name
EF INTERNATIONAL LANGUAGE CAMPUS COSTA MESA

Project Number
05.9948.500

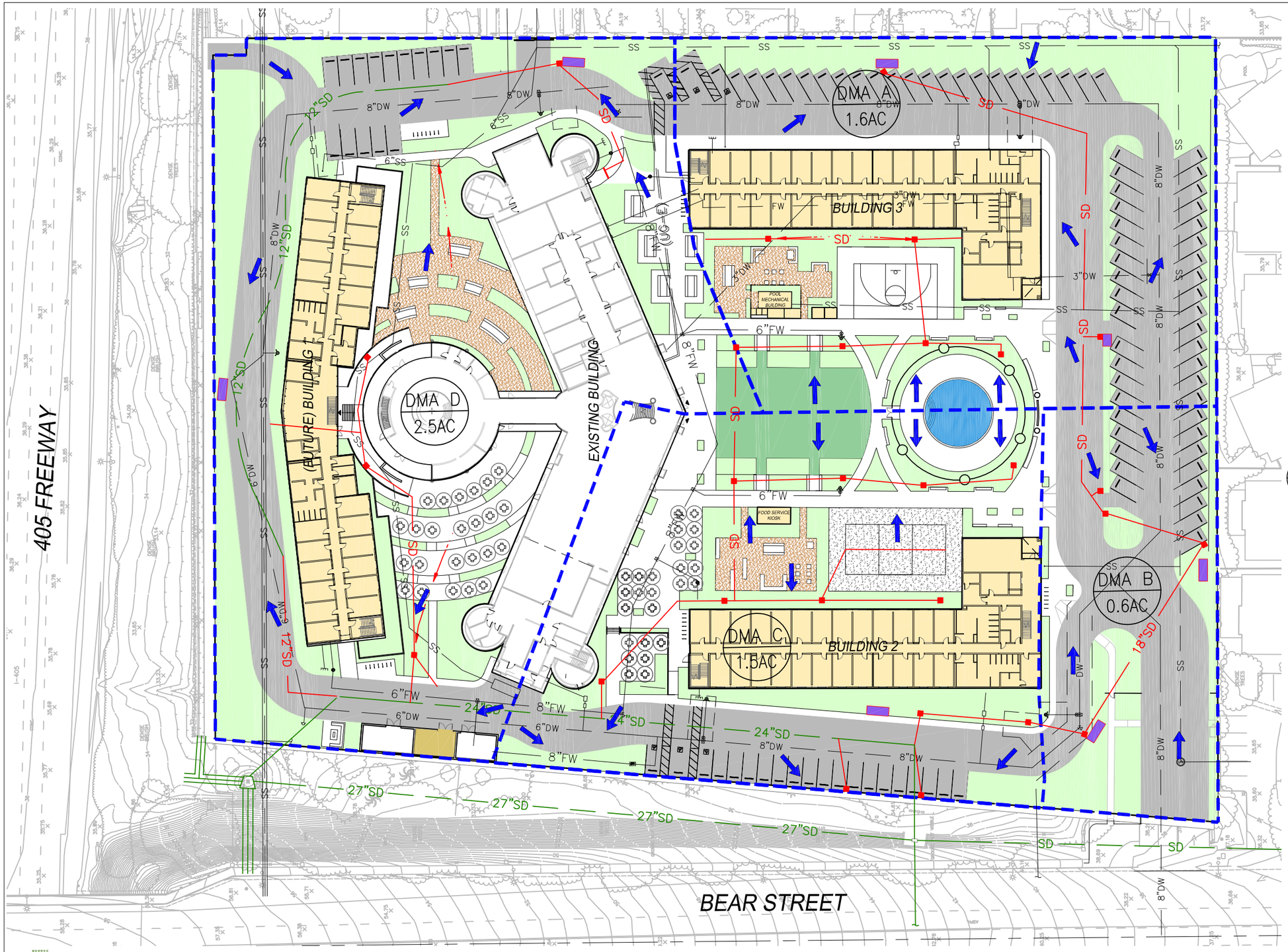
Description
OVERALL SITE

Scale
1" = 20'-0"

SP-A0.103CUP

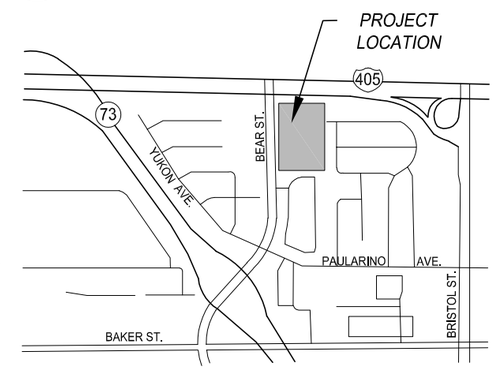
© 2019 Gensler

3/22/2019 5:54:21 PM \\gensler.net\Projects\Revit\bsm\Models\17146\05.9948.500_EF Costa Mesa_CUP_v18_rodrigo_barrantes@gensler.com.rvt



LEGEND

- PROPERTY LINE
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- BMP DRAINAGE AREA BOUNDARY
- PROPOSED COMMON AREA LANDSCAPING
- PROPOSED TURF
- PROPOSED D.G.
- PROPOSED BUILDING
- STREET SWEEPING PRIVATE STREETS & PARKING LOTS
- PROPOSED POOLS & FOUNTAINS
- PROPOSED TRASH ENCLOSURE
- MODULAR WETLAND SYSTEM BMP
- DIRECTION OF SURFACE FLOW
- CATCH BASIN STENCILING & MAINTENANCE
- DRAINAGE MANAGEMENT AREA ACREAGE (DMA A / 1.42 AC)



VICINITY MAP

EF EDUCATION FIRST, COSTA MESA CAMPUS
3150 BEAR STREET, COSTA MESA, CA

60' 0' 30' 60'

SCALE: 1" = 60'

N

Scale: 1" = 60'
Exhibit Date: 04/05/2019

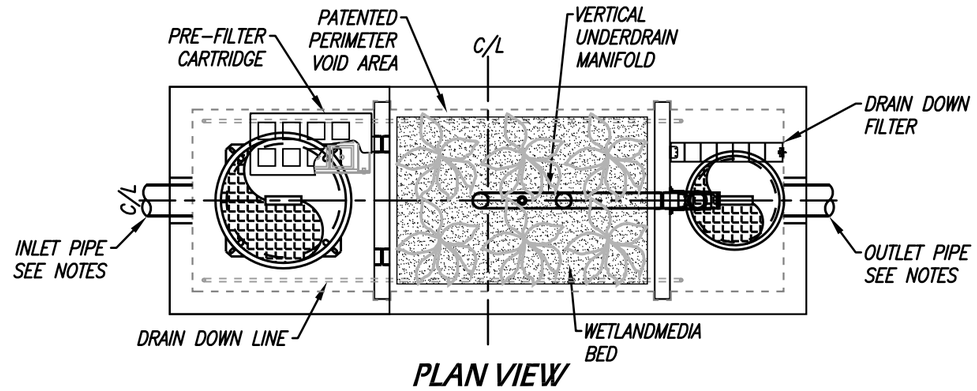
PRELIMINARY WATER QUALITY MANAGEMENT PLAN

EF COSTA MESA CAMPUS
COSTA MESA, CA

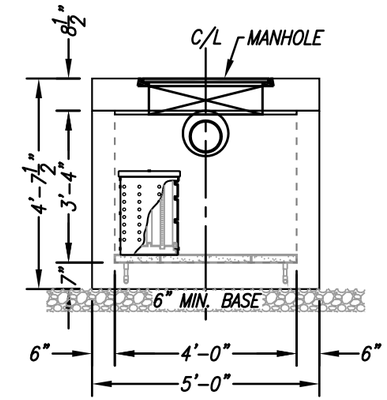
FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 • fax 949.474.5315
www.fuscoe.com

\\FUSCOE.CORP\IRV\PANZURA\PROJECTS\1793\001_SUPPORT FILES\REPORTS\WQMP\PRELIMINARY\SECTION 6 GRAPHICS\1793-001XH_EF EDUCATION WQMP_2019-01-24.DWG (04-04-19 6:02:20PM) Plotted by: Sarah Johnson

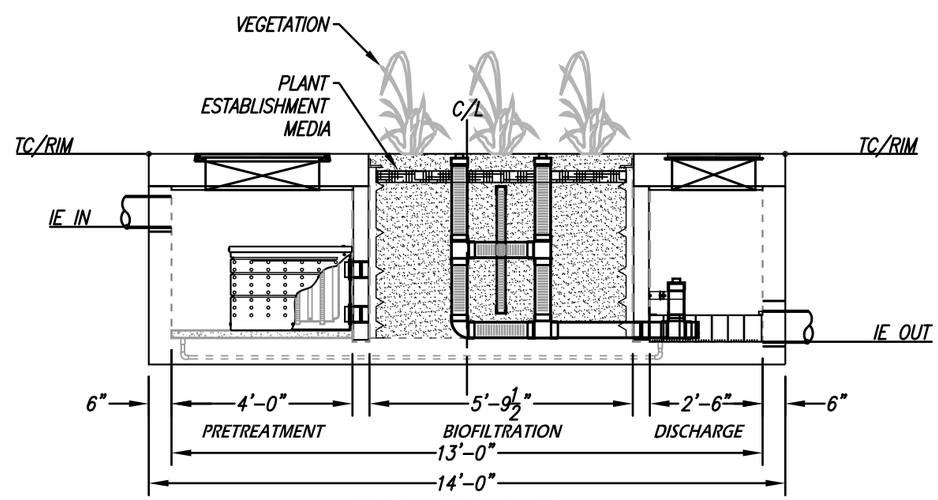
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	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:			



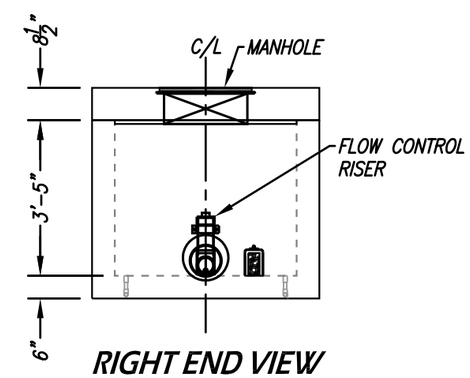
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
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.
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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.

GENERAL NOTES

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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

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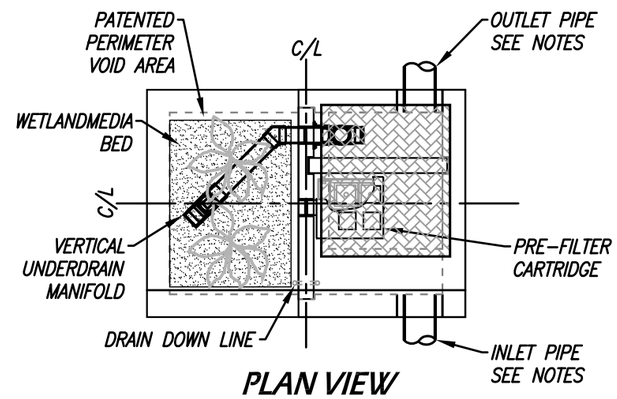
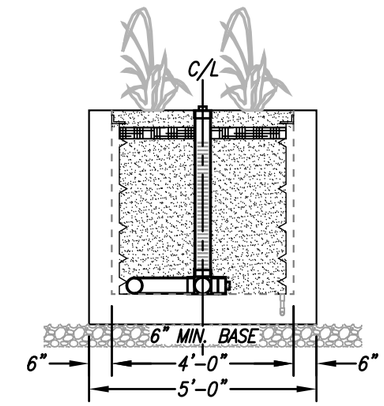
MWS-L-4-13-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

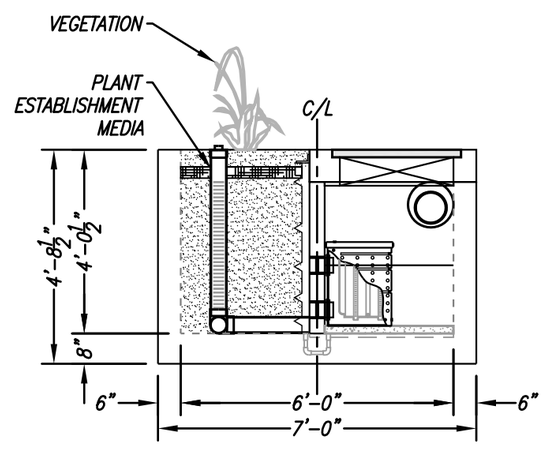
SITE SPECIFIC DATA			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	30" X 36"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			1.48
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.22"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			



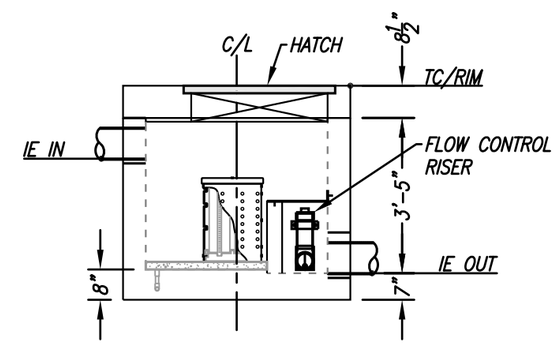
PLAN VIEW



LEFT END VIEW
BIOFILTRATION



ELEVATION VIEW



RIGHT END VIEW
PRETREATMENT/DISCHARGE

INSTALLATION NOTES

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GENERAL NOTES

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TREATMENT FLOW (CFS)	0.073
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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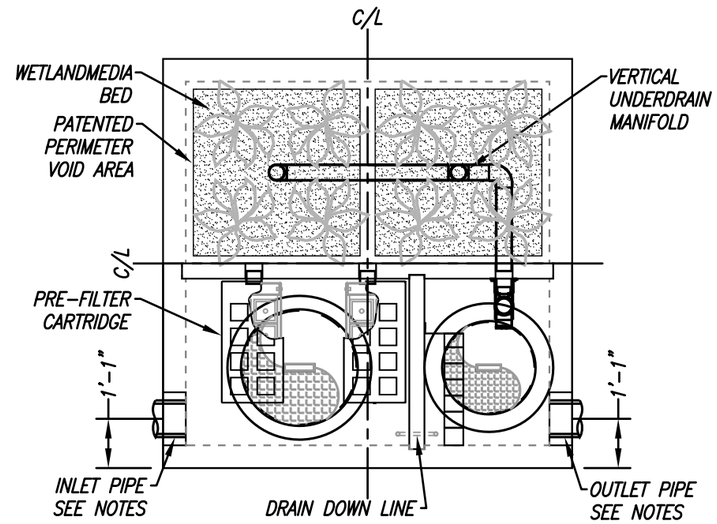
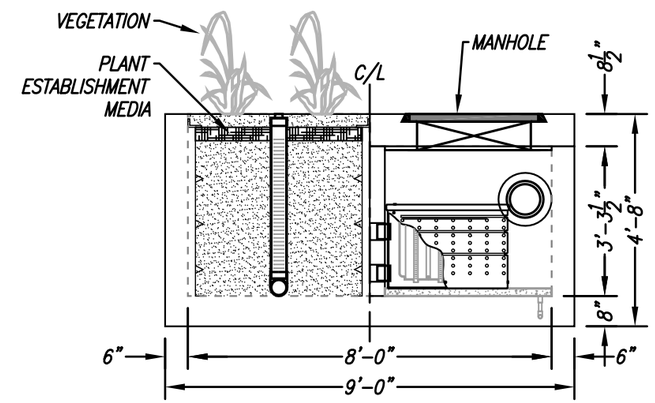
MWS-L-4-6-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

SITE SPECIFIC DATA			
PROJECT NUMBER			
ORDER NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
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	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			TBD
ORIFICE SIZE (DIA. INCHES)			TBD
NOTES: PRELIMINARY NOT FOR CONSTRUCTION.			



PLAN VIEW



LEFT END VIEW

INSTALLATION NOTES

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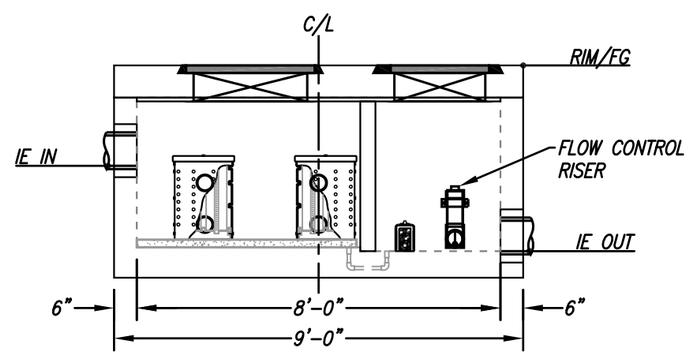
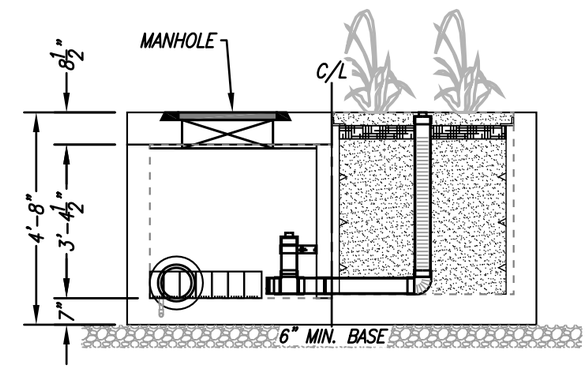
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.



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

GENERAL NOTES

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MODULAR WETLANDS

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Bio Clean
A Forterra Company

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

BIO-7: Proprietary Biotreatment

Proprietary biotreatment devices are devices that are manufactured to mimic natural systems such as bioretention areas by incorporating plants, soil, and microbes engineered to provide treatment at higher flow rates or volumes and with smaller footprints than their natural counterparts. Incoming flows are typically filtered through a planting media (mulch, compost, soil, plants, microbes, etc.) and either infiltrated or collected by an underdrain and delivered to the storm water conveyance system. Tree box filters are an increasingly common type of proprietary biotreatment device that are installed at curb level and filled with a bioretention type soil. For low to moderate flows they operate similarly to bioretention systems and are bypassed during high flows. Tree box filters are highly adaptable solutions that can be used in all types of development and in all types of soils but are especially applicable to dense urban parking lots, street, and roadways.

Also known as:

- *Catch basin planter box*
- *Bioretention vault*
- *Tree box filter*

Proprietary biotreatment
Source: http://www.americastusa.com /index.php/filterra/

Feasibility Screening Considerations

- Proprietary biotreatment devices that are unlined may cause incidental infiltration. Therefore, an evaluation of site conditions should be conducted to evaluate whether the BMP should include an impermeable liner to avoid infiltration into the subsurface.

Opportunity Criteria

- Drainage areas of 0.25 to 1.0 acres.
- Land use may include commercial, residential, mixed use, institutional, and subdivisions. Proprietary biotreatment facilities may also be applied in parking lot islands, traffic circles, road shoulders, and road medians.
- Must not adversely affect the level of flood protection provided by the drainage system.

OC-Specific Design Criteria and Considerations

- ☐ Frequent maintenance and the use of screens and grates to keep trash out may decrease the likelihood of clogging and prevent obstruction and bypass of incoming flows.
- ☐ Consult proprietors for specific criteria concerning the design and performance.
- ☐ Proprietary biotreatment may include specific media to address pollutants of concern. However, for proprietary device to be considered a biotreatment device the media must be capable of supporting rigorous growth of vegetation.
- ☐ Proprietary systems must be acceptable to the reviewing agency. Reviewing agencies shall have the discretion to request performance information. Reviewing agencies shall have the discretion to deny the use of a proprietary BMP on the grounds of performance, maintenance considerations, or other relevant factors.

☐ In right of way areas, plant selection should not impair traffic lines of site. Local jurisdictions may also limit plant selection in keeping with landscaping themes.

Computing Sizing Criteria for Proprietary Biotreatment Device

- Proprietary biotreatment devices can be volume based or flow-based BMPs.
- Volume-based proprietary devices should be sized using the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1** or the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs described in **Appendix III.3.2**.
- The required design flowrate for flow-based proprietary devices should be computed using the Capture Efficiency Method for Flow-based BMPs described in **Appendix III.3.3)**.

Additional References for Design Guidance

- Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4: **http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850**
- Los Angeles County Stormwater BMP Design and Maintenance Manual, Chapter 9: **http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf**
- Santa Barbara BMP Guidance Manual, Chapter 6: **http://www.santabarbaraca.gov/NR/rdonlyres/91D1FA75-C185-491E-A882-49EE17789DF8/0/Manual_071008_Final.pdf**

SECTION VII EDUCATIONAL MATERIALS

The educational materials included in this WQMP are provided to inform people involved in future uses, activities, or ownership of the site about the potential pitfalls associated with careless storm water management. "The Ocean Begins at Your Front Door" provides users with information about storm water that is/will be generated on site, what happens when water enters a storm drain, and its ultimate fate, discharging into the ocean. Also included are activities guidelines to educate anyone who is or will be associated with activities that have a potential to impact storm water runoff quality, and provide a menu of BMPs to effectively reduce the generation of storm water runoff pollutants from a variety of activities. The educational materials that may be used for the proposed project are included in Appendix C of this WQMP and are listed below.

EDUCATION MATERIALS			
Residential Materials (http://www.ocwatersheds.com)	**Check If Attached**	**Business Materials (http://www.ocwatersheds.com)**	**Check If Attached**
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☐	Tips for Using Concrete and Mortar	☐
Tips for the Home Mechanic	☐	Tips for the Food Service Industry	☐
Homeowners Guide for Sustainable Water Use	☐	Proper Maintenance Practices for Your Business	☐
Household Tips	☐	**Other Materials (http://www.ocwatersheds.com) (https://www.casqa.org/resources/bmp-handbooks)**	**Check If Attached**
Proper Disposal of Household Hazardous Waste	☐		
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 Septic Tank Systems	☐	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	☒
Tips for Protecting Your Watershed	☒	SD-31 Maintenance Bays & Docs	☐
Other: Children's Brochure	☐	SD-32 Trash Storage Areas	☒

APPENDICES

Appendix A .....Supporting Calculations
Appendix B .....Notice of Transfer of Responsibility
Appendix C .....Educational Materials
Appendix D .....BMP Maintenance Supplement / O&M Plan
Appendix E.....Conditions of Approval (Pending Issuance)
Appendix F .....Infiltration Test Results

Appendix A

Supporting Calculations

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.

Project Site

0 3 6 12 Kilometers
0 1.8 3.6 7.2 Miles

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

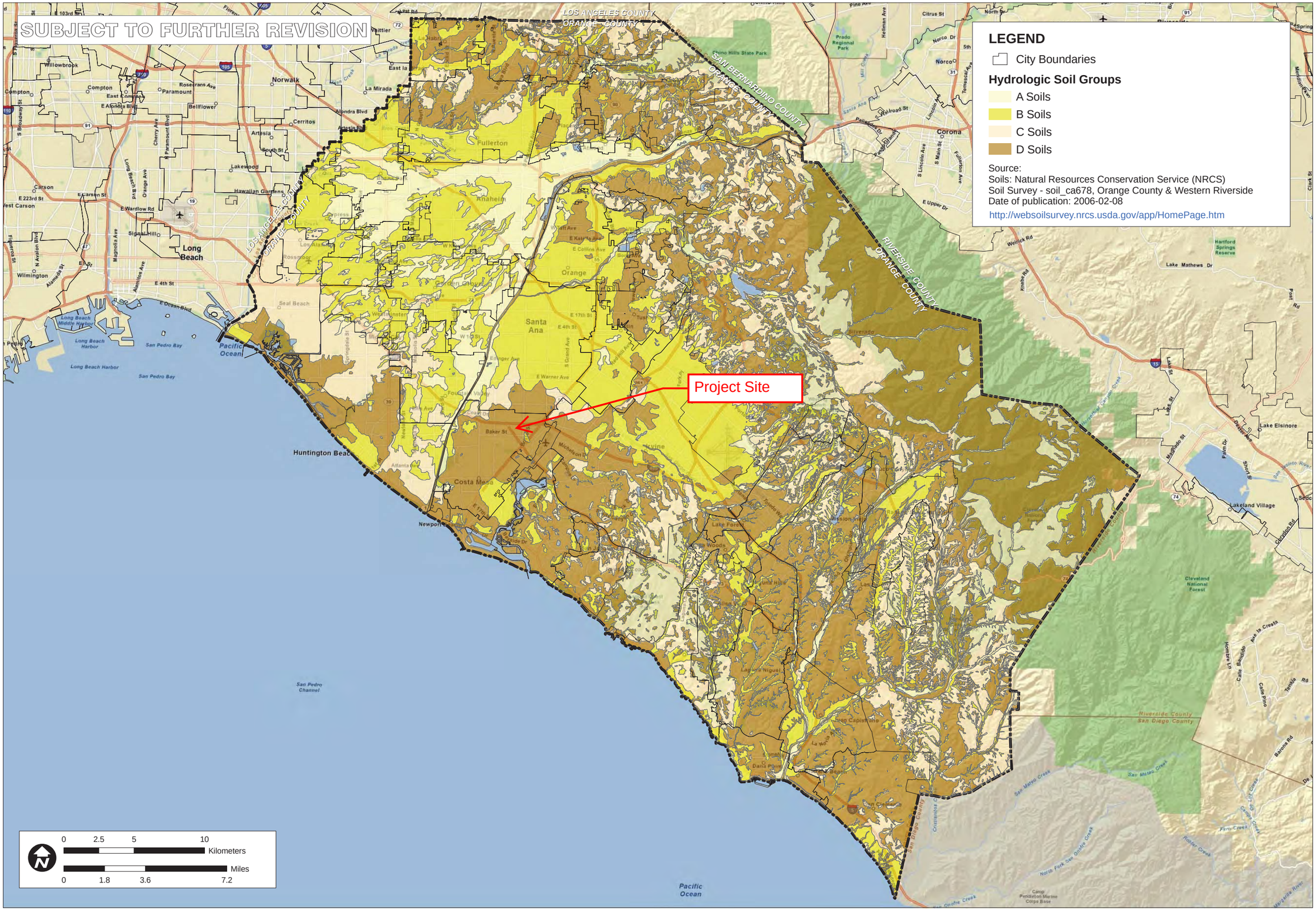
TITLE: RAINFALL ZONES

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



NRCS HYDROLOGIC SOILS GROUPS

TITLE

ORANGE COUNTY INFILTRATION STUDY

CA

JOB

ORANGE CO.

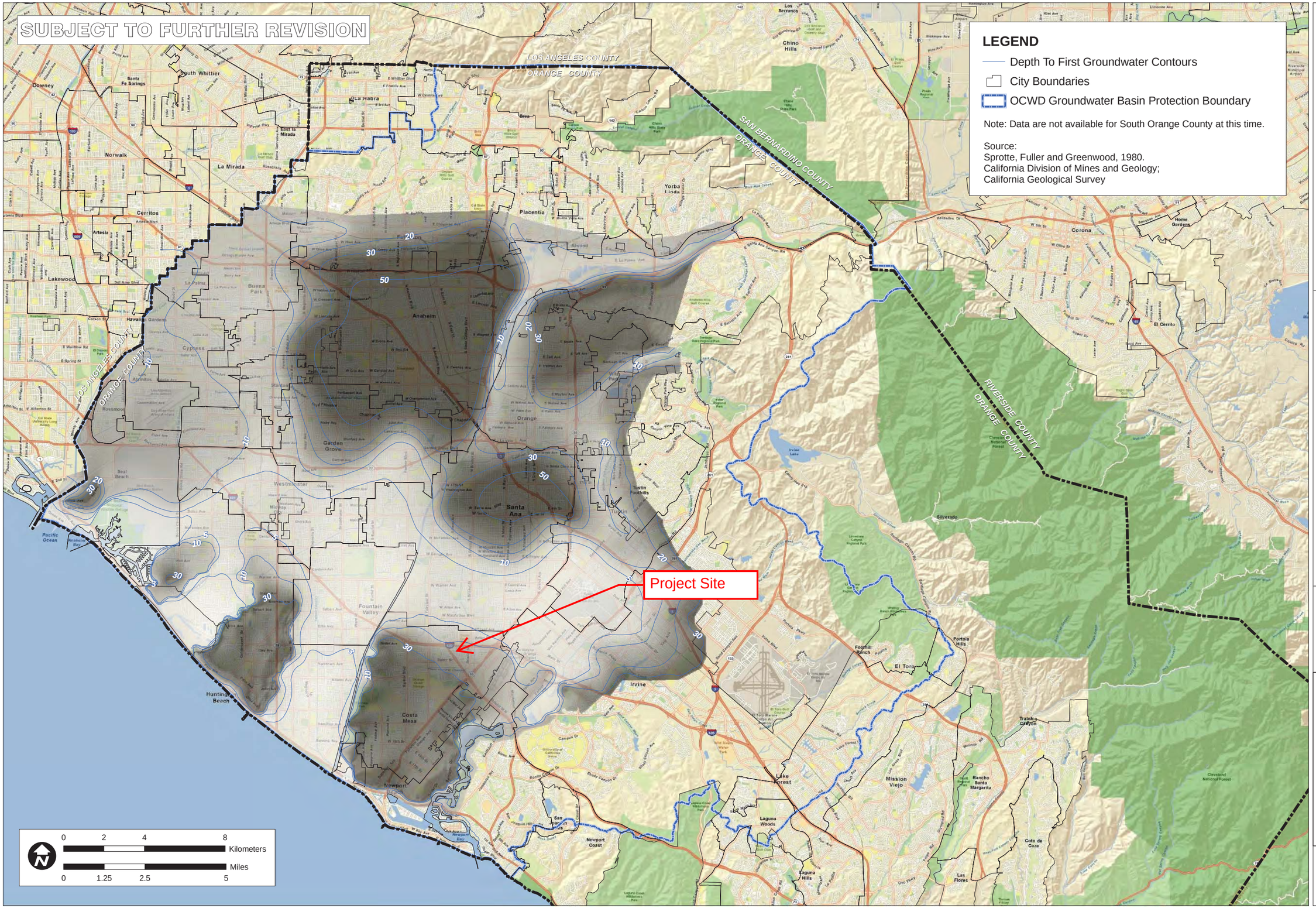
SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE Advanced Water Engineering

FIGURE

XVI-2a

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2a_HydroSoils_20110215.mxd



TITLE
NORTH ORANGE COUNTY
MAPPED DEPTH TO FIRST
GROUNDWATER

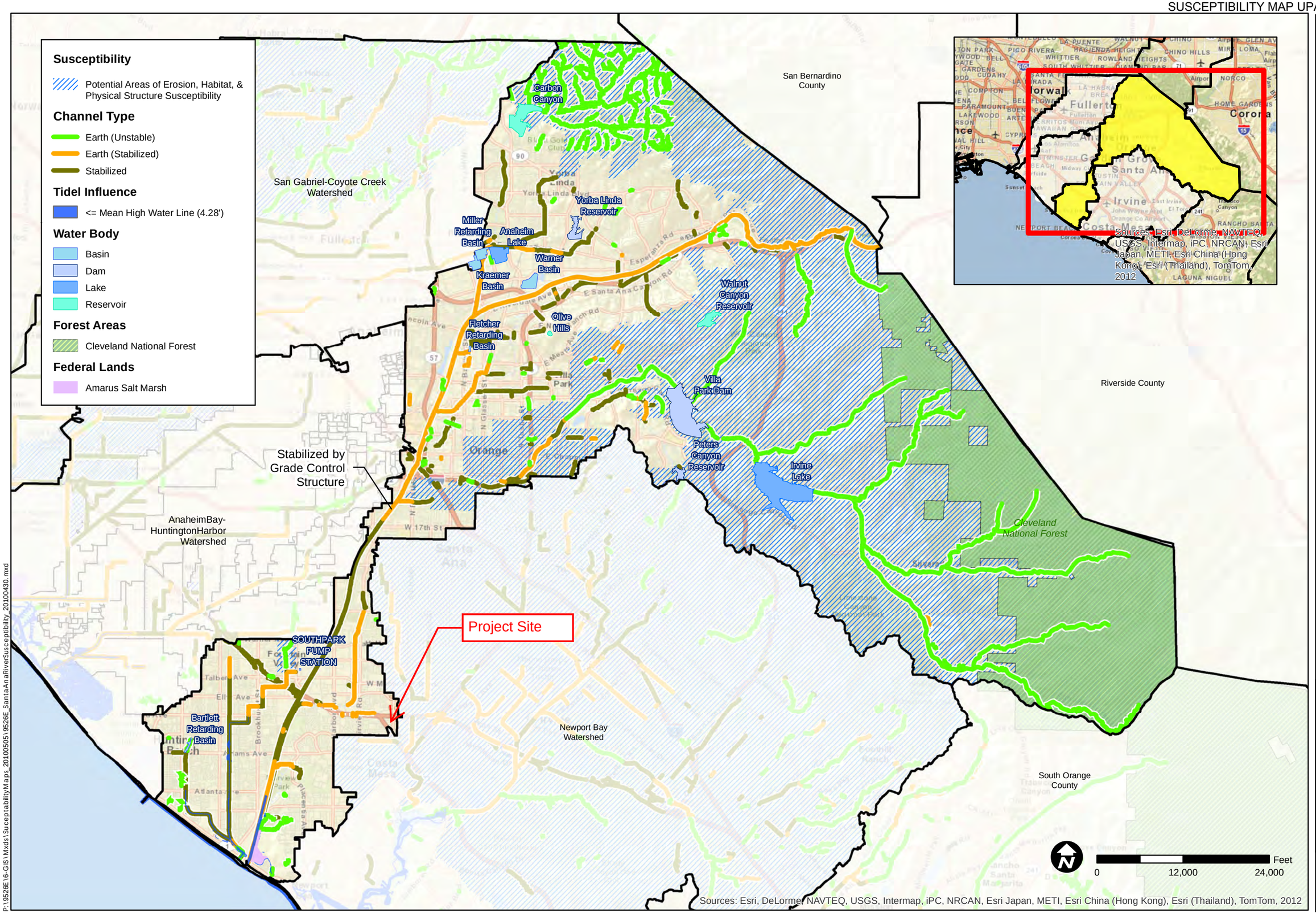
JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO.
CA

SCALE	1" = 1.25 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2d

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2d_DepthToGroundwaterOverview_20110215.mxd



TITLE
SUSCEPTIBILITY ANALYIS
SANTA ANA RIVER

JOB
ORANGE COUNTY
WATERSHED
MASTER PLANNING
ORANGE CO.
CA

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

PACE
Advanced Water Engineering

FIGURE
3

P:\9526E\6-GIS\Mxds\SuceptabilityMaps_20100505\9526E_SantaAnaRiverSusceptibility_20100430.mxd

Table 2.7: Infiltration BMP Feasibility Worksheet

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

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

	Partial Infeasibility Criteria	***Yes***	***No***
4	Is proposed infiltration facility **located on HSG D soils** or the site geotechnical investigation identifies presence of soil characteristics which support categorization as D soils?	X	
Provide basis: *According to the TGD Figure XVI-2a, the project site is located on HSG Type D soils.* Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
5	Is **measured infiltration rate below proposed facility less than 0.3 inches per hour**? This calculation shall be based on the methods described in Appendix VII.	X	
Provide basis: *Three preliminary percolation tests were performed in general conformance with the Santa Ana Regional Water Quality Control Board Technical Guidance Document (TGD). The percolation borings were drilled to a maximum depth of 5 feet below the existing grade using a hollow-stem-auger, truck-mounted drill rig. A safety factor of 2 was used to calculate infiltration rates ranging from 0.01 to 0.02 in/hr. The calculated infiltrate rates do not meet the minimum requirement of 0.3 inches/hour per the TGD manual. On this basis, infiltration of storm water into the site soils is deemed infeasible.* Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
6	Would **reduction of over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
7	Would **an increase in infiltration over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.		
Infiltration Screening Results (check box corresponding to result):		
8	Is there substantial evidence that infiltration from the project would result in a significant increase in I&I to the sanitary sewer that cannot be sufficiently mitigated? (See Appendix XVII) Provide narrative discussion and supporting evidence: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.	
9	If any answer from row 1-3 is yes: infiltration of any volume is **not feasible** within the DMA or equivalent. Provide basis: Summarize findings of infeasibility screening	
10	If any answer from row 4-7 is yes, infiltration is **permissible but is not presumed to be feasible for the entire DCV.** Criteria for designing biotreatment BMPs to achieve the maximum feasible infiltration and ET shall apply. Provide basis: *Poor infiltrating soils resulted in the project utilizing evapotranspiration and biotreatment BMPs. See Section IV.3.4 of the WQMP report for further discussion on Biotreatment BMPs.* Summarize findings of infeasibility screening	X

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

11	If all answers to rows 1 through 11 are no, infiltration of the full DCV is potentially feasible, BMPs must be designed to infiltrate the full DCV to the maximum extent practicable.	

Harvest & Reuse Irrigation Demand Calculations

4/4/2019

Storm Water Design Caputre 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	4.46	1.73	72%	0.690	0.75	6.188	**11,624.3**	**86,950**
				0.150			**0.0**	**0**
				0.150			**0.0**	**0**
				0.675			**0.0**	**0**
				0.698			**0.0**	**0**
				0.698			**0.0**	**0**

	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	Minimum EAWU/ Impervious Acre (Table X.6)	Feasible?	EIATA	Minimum EIATA (interpo-lated)	Drawdown (days)	Drawdown (hours)	% Capture (Fig. III.2)
Total Site	6.188	269,549	72%	194,075	75,474	3	0.55	2,075.53	465.85	610	No	0.24	0.00	41.9	1,005	<40
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	
0	0.000	0	0%	0	0		0.55	0.00	#DIV/0!			#DIV/0!	0.00	#DIV/0!	#DIV/0!	

TABLE X.6: HARVESTED WATER DEMAND THRESHOLDS FOR MINIMUM PARTIAL CAPTURE

Design Capture Storm Depth, inches	Wet Season Demand Required for Minimum Partial Capture, gpd per impervious acre
0.60	490
0.65	530
0.70	570
0.75	610
0.80	650
0.85	690
0.90	730
0.95	770
1.00	810

TABLE X.8: MINIMUM IRRIGATED AREA FOR POTENTIAL PARTIAL CAPTURE FEASIBILITY

General Landscape Type	Conservation Design: KL = 0.35			Active Turf Areas: KL = 0.7		
Closest ET Station	Irvine	Santa Ana	Laguna	Irvine	Santa Ana	Laguna
Design Capture Storm Depth, inches	Minimum Required Irrigated Area per Tributary Impervious Acre for Potential Partial Capture, ac/ac					
0.60	0.66	0.68	0.72	0.33	0.34	0.36
0.65	0.72	0.73	0.78	0.36	0.37	0.39
0.70	0.77	0.79	0.84	0.39	0.39	0.42
0.75	0.83	0.84	0.9	0.41	0.42	0.45
0.80	0.88	0.9	0.96	0.44	0.45	0.48
0.85	0.93	0.95	1.02	0.47	0.48	0.51
0.90	0.99	1.01	1.08	0.49	0.51	0.54
0.95	1.04	1.07	1.14	0.52	0.53	0.57
1.00	1.1	1.12	1.2	0.55	0.56	0.6

Source: Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs). March 22, 2011. Appendix X.

Worksheet B: Simple Design Capture Volume Sizing Method

Project: EF Costa Mesa Campus

Date: April 5, 2019

		DMA =	DMA A	DMA B	DMA C	DMA D	
Step 1: Determine the design capture storm depth used for calculating volume							
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.75	0.75	0.75	0.75	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	0	0	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.75	0.75	0.75	0.75	inches
Step 2: Calculate the DCV							
1	Enter Project area tributary to BMP(s), *A* (acres)	A=	1.600	0.600	1.500	2.500	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	70.0%	73.0%	73.0%	73.0%	%
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.675	0.698	0.698	0.698	
4	Calculate runoff volume, $V_{design} = (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	2,940.3	1,140.2	2,850.5	4,750.8	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV							
Step 3a: Determine design infiltration rate							
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	N/A	N/A	N/A	N/A	in/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	N/A	N/A	N/A	N/A	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	N/A	N/A	N/A	N/A	in/hr
Step 3b: Determine minimum BMP footprint							
4	Enter drawdown time, *T* (max 48 hours)	T=	*See Worksheet D*	*See Worksheet D*	*See Worksheet D*	*See Worksheet D*	hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=					feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=					sq-ft

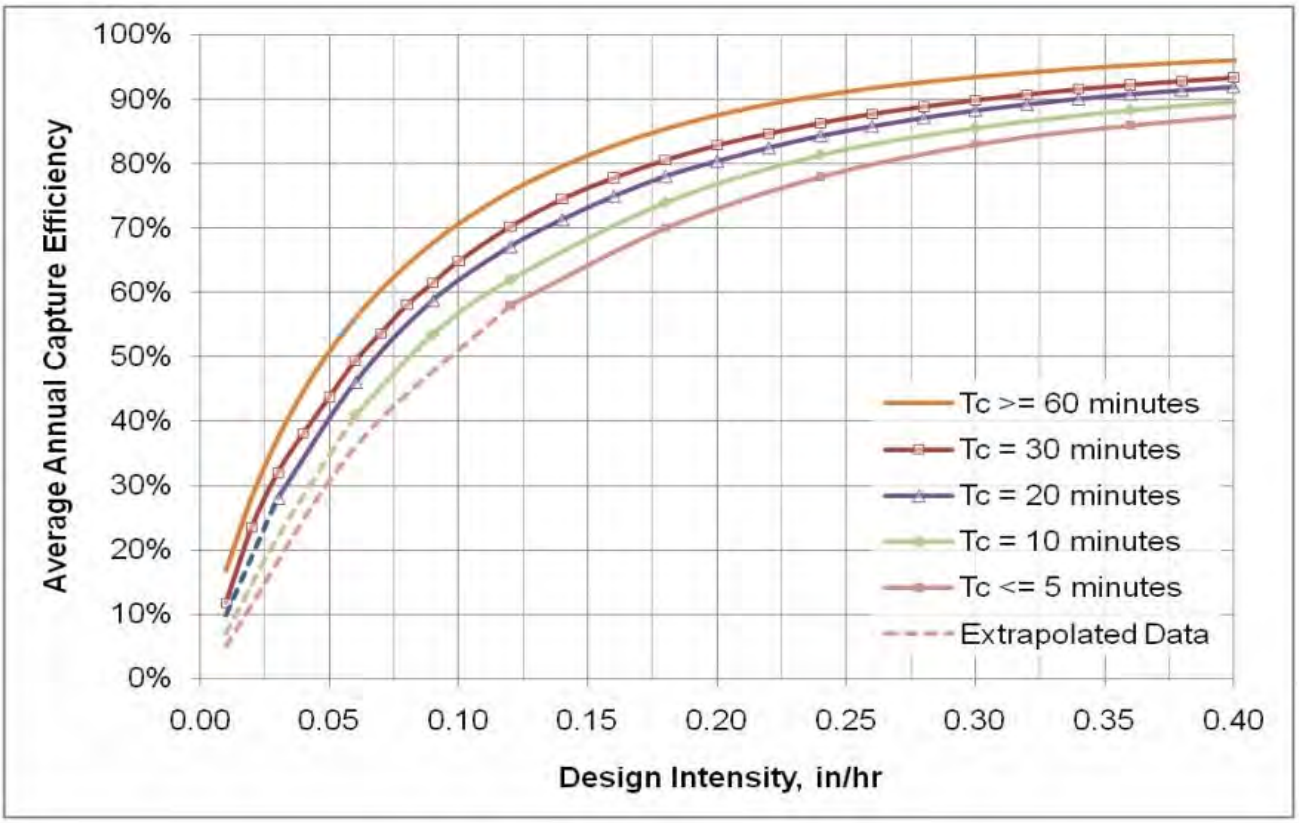
Worksheet D: Capture Efficiency Method for Flow-Based BMPs

Project: EF Costa Mesa Campus

Date: April 5, 2019

			DMA A	DMA B	DMA C	DMA D	
Step 1: Determine the design capture storm depth used for calculating volume							
1	Enter the time of concentration, T_c (min) (See Appendix IV.2)	T_c=	5.0	5.0	5.0	5.0	min
2	Using Figure III.4, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.260	0.260	0.260	0.260	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	0	0	0	in
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	0%	0%	0%	0%	%
5	Using Figure III.4, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency (Y_2), I_2	I_2=	0	0	0	0	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design} = I_1 - I_2$	I_{design}=	0.260	0.260	0.260	0.260	in/hr
Step 2: Calculate the design flowrate							
1	Enter Project area tributary to BMP(s), A (acres)	A=	1.600	0.600	1.500	2.500	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	70.0%	73.0%	73.0%	73.0%	%
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.675	0.698	0.698	0.698	
4	Calculate design flowrate, $Q_{design} = (C \times i_{design} \times A)$	Q_{design}=	0.281	0.109	0.272	0.454	cfs
Supporting Calculations							
Describe System:							
	Proprietary BioTreatment (BIO-7):						
	Unit Size / Model =		*MWS-L-4-13*	*MWS-L-4-6*	*MWS-L-4-13*	*MWS-L-8-8*	
	Unit Size / Model Treatment Capacity =		*0.144*	*0.073*	*0.144*	*0.231*	cfs
	Number of Units Needed =		*2*	*2*	*2*	*2*	
	Total Bio-treatment Provided =		*0.288*	*0.146*	*0.288*	*0.462*	cfs
Provide time of concentration assumptions:							
							min

Figure III.4. Capture Efficiency Nomograph for Off-line Flow-based Systems in Orange County



Appendix B

Notice of Transfer of Responsibility

NOTICE OF TRANSFER OF RESPONSIBILITY

WATER QUALITY MANAGEMENT PLAN

EF Costa Mesa Campus
Tract 3885

Submission of this Notice Of Transfer of Responsibility constitutes notice to the City of Costa Mesa 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:

Appendix C

Educational Materials

The Ocean Begins at Your Front Door

Orange County Stormwater Program

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

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

PROJECT Pollution PREVENTION

Did You Know?

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

Where Does It Go?

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

Sources of Non-Point Source Pollution

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

The Effect on the Ocean

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

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

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

For More Information

California Environmental Protection Agency
www.calepa.ca.gov

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

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

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

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

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

Stormwater Best Management Practice Handbook
Visit www.cabmphandbooks.com

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

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

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

Orange County 24-Hour
Water Pollution Problem Reporting Hotline
1-877-89-SPILL (1-877-897-7455)

On-line Water Pollution Problem Reporting Form

www.ocwatersheds.com

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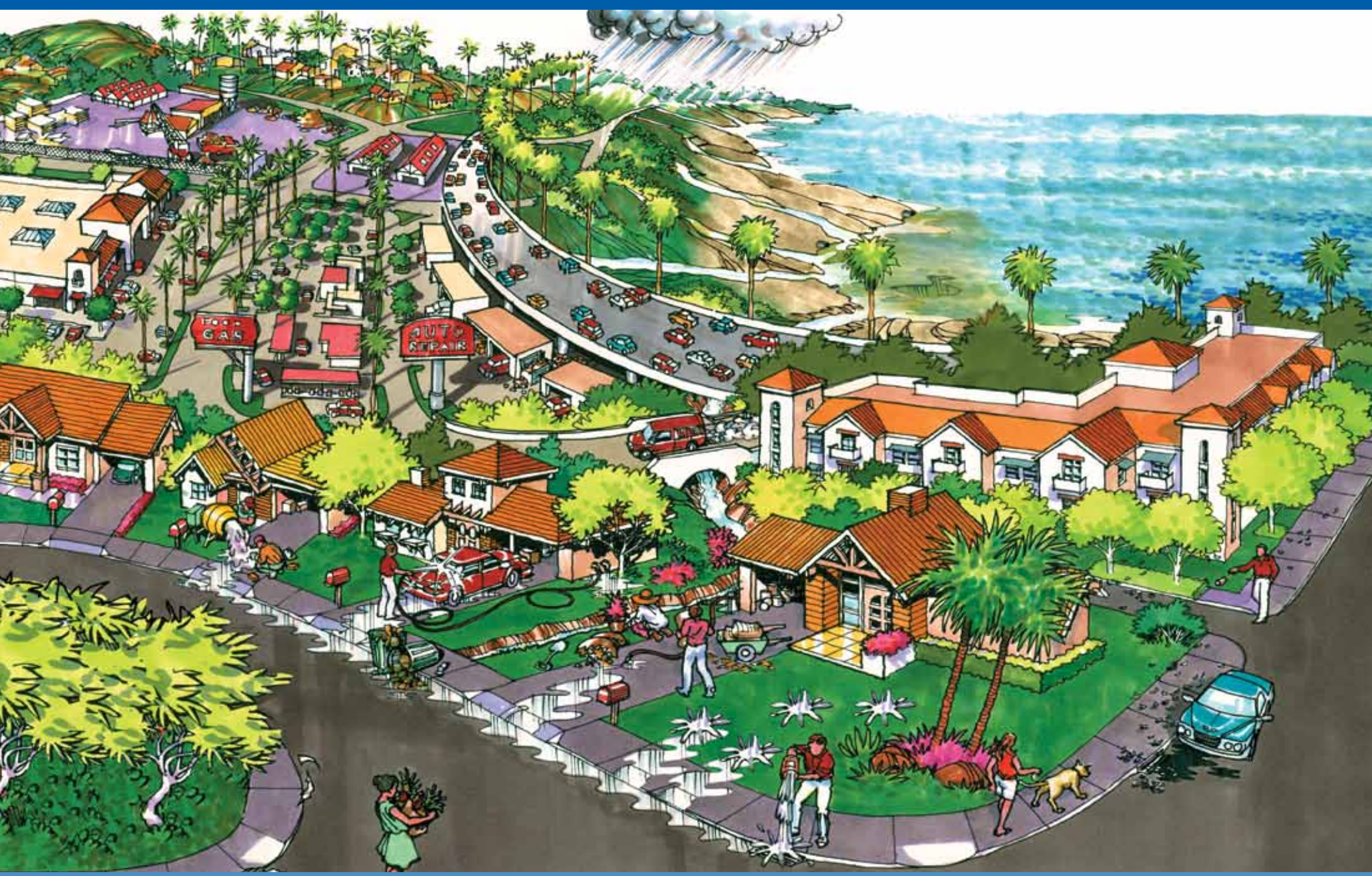
The Ocean Begins at Your Front Door



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

Follow these simple steps to help reduce water pollution:

Household Activities

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

Automotive

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

Pool Maintenance

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

Landscape and Gardening

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

Trash

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

Pet Care

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

Common Pollutants

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

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

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

Did you know that just one quart of oil can pollute 250,000 gallons of water?

A clean ocean and healthy creeks, rivers, bays and beaches are important to Orange County. However, not properly disposing of used oil can lead to water pollution. If you pour or drain oil onto driveways, sidewalks or streets, it can be washed into the storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering the ocean. Help prevent water pollution by taking your used oil to a used oil collection center.

Included in this brochure is a list of locations that will accept up to five gallons of used motor oil at no cost. Many also accept used oil filters. Please contact the facility before delivering your used oil. This listing of companies is for your reference and does not constitute a recommendation or endorsement of the company.

Please note that used oil filters may not be disposed of with regular household trash. They must be taken to a household hazardous waste collection or recycling center in Anaheim, Huntington Beach, Irvine or San Juan Capistrano. For information about these centers, visit www.oclandfills.com.

Please do not mix your oil with other substances!

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

For information about the proper disposal of household hazardous waste, call the Household Waste Hotline at (714) 834-6752 or visit www.oclandfills.com.

RECYCLE USED OIL

For additional information about the nearest oil recycling center, call the Used Oil Program at 1-800-CLEANUP or visit www.cleanup.org.

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Help Prevent Ocean Pollution:

Recycle at Your Local Used Oil Collection Center

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

NORTH COUNTY

Used Oil Collection Centers

Anaheim

All Seasons Tire and Auto Center, Inc.
817 S Brookhurst St., Anaheim, CA 92804
(714)772-6090( )
CIWMB#: 30-C-03177

AutoZone #3317
423 N Anaheim Blvd., Anaheim, CA 92805
(714)776-0787( )
CIWMB#: 30-C-05263

AutoZone #5226
2145 W Lincoln Ave., Anaheim, CA 92801
(714)533-6599( )
CIWMB#: 30-C-04604

Bedard Automotive
3601 E Miraloma Ave., Anaheim, CA 92806
(714)528-1380( )
CIWMB#: 30-C-02205

Classic Chevrolet
1001 Weir Canyon Rd., Anaheim, CA 92807
(714)283-5400( )
CIWMB#: 30-C-05223

Econo Lube N' Tune #4
3201 W Lincoln Ave., Anaheim, CA 92801
(714)821-0128( )
CIWMB#: 30-C-01485

EZ Lube Inc - Savi Ranch #43
985 N Weir Canyon Rd., Anaheim, CA 92807
(714)556-1312( )
CIWMB#: 30-C-06011

Firestone Store #71C7
1200 S Magnolia Ave., Anaheim, CA 92804
(949)598-5520( )
CIWMB#: 30-C-05743

Great Western Lube Express
125 N Brookhurst St., Anaheim, CA 92801
(714)254-1300( )
CIWMB#: 30-C-05542

HR Pro Auto Service Center
3180 W Lincoln Ave., Anaheim, CA 92801
(714)761-4343( )
CIWMB#: 30-C-05927

Ira Newman Automotive Services
1507 N State College Blvd., Anaheim, CA 92806
(714)635-2392( )
CIWMB#: 30-C-01482

Jiffy Lube #1028
2400 W Ball Rd., Anaheim, CA 92804
(714)761-5211( )
CIWMB#: 30-C-00870

Jiffy Lube #1903
2505 E Lincoln Ave., Anaheim, CA 92806
(714)772-4000( )
CIWMB#: 30-C-05511

Jiffy Lube #2340
2181 W Lincoln Ave., Anaheim, CA 92801
(714)533-1000( )
CIWMB#: 30-C-04647

Kragen Auto Parts #1303
1088 N State College Blvd., Anaheim, CA 92806
(714)956-7351( )
CIWMB#: 30-C-03438

Kragen Auto Parts #1399
2245 W Ball Rd., Anaheim, CA 92804
(714)490-1274( )
CIWMB#: 30-C-04094

Kragen Auto Parts #1565
2072 Lincoln Ave., Anaheim, CA 92806
(714)502-6992( )
CIWMB#: 30-C-04078

Kragen Auto Parts #1582
3420 W Lincoln Ave., Anaheim, CA 92801
(714)828-7977( )
CIWMB#: 30-C-04103

Pep Boys #613
10912 Katella Ave., Anaheim, CA 92804
(714)638-0863( )
CIWMB#: 30-C-01756

Pep Boys #663
3030 W Lincoln Anaheim, CA 92801
(714)826-4810( )
CIWMB#: 30-C-03417

Pep Boys #809
8205 E Santa Ana Cyn Rd., Anaheim, CA 92808
(714)974-0105( )
CIWMB#: 30-C-03443

Pick Your Part
1235 S Beach Blvd., Anaheim, CA 92804
(714)527-1645( )
CIWMB#: 30-C-03744

PK Auto Performance
3106 W. Lincoln Ave., Anaheim, CA 92801
(714)826-2141( )
CIWMB#: 30-C-05628

Quick Change Lube and Oil
2731 W Lincoln Ave., Anaheim, CA 92801
(714)821-4464( )
CIWMB#: 30-C-04363

Saturn of Anaheim
1380 S Auto Center Dr., Anaheim, CA 92806
(714)648-2444( )
CIWMB#: 30-C-06332

Sun Tech Auto Service
105 S State College Blvd., Anaheim, CA 92806
(714)956-1389( )
CIWMB#: 30-C-06455

Vonic Truck Services
515 S Rose St., Anaheim, CA 92805
(714)533-3333( )
CIWMB#: 30-C-01142

Anaheim Hills

Anaheim Hills Car Wash & Lube
5810 E La Palma Ave., Anaheim Hills, CA 92807
(714)777-6605( )
CIWMB#: 30-C-01387

Brea

Firestone Store #27A9
891 E Imperial Hwy., Brea, CA 92821
(714)529-8404( )
CIWMB#: 30-C-01221

Oil Can Henry's
230 N Brea Blvd., Brea, CA 92821
(714)990-1900( )
CIWMB#: 30-C-04273

Buena Park

Firestone Store #71F7
6011 Orangethorpe Buena Park, CA 90620
(714)670-7912( )
CIWMB#: 30-C-01218

Firestone Store #71T8
8600 Beach Blvd., Buena Park, CA 90620
(714)827-5300( )
CIWMB#: 30-C-02121

Kragen Auto Parts #1204
5303 Beach Blvd., Buena Park, CA 90621
(714)994-1320( )
CIWMB#: 30-C-02623

Cypress

AutoZone #5521
5471 Lincoln Ave., Cypress, CA 90630
(714)995-4644( )
CIWMB#: 30-C-00836

Big O Tires
6052 Cerritos Ave., Cypress, CA 90630
(714)826-6334( )
CIWMB#: 30-C-04245

Econo Lube N' Tune #213
5497 Cerritos Ave., Cypress, CA 90630
(714)761-0456( )
CIWMB#: 30-C-06240

Jiffy Lube #851
4942 Lincoln Ave., Cypress, CA 90630
(626)965-9689( )
CIWMB#: 30-C-06182

M & N Coastline Auto & Tire Service
4005 Ball Rd., Cypress, CA 90630
(714)826-1001( )
CIWMB#: 30-C-04387

Masterlube #103
5904 Lincoln Cypress, CA 90630
(714)826-2323( )
CIWMB#: 30-C-01071

Masterlube #104
5971 Ball Rd., Cypress, CA 90630
(714)220-1555( )
CIWMB#: 30-C-04682

Metric Motors of Cypress
6042 Cerritos Ave., Cypress, CA 90630
(714)821-4702( )
CIWMB#: 30-C-05157

Fullerton

AutoZone #2898
146 N. Raymond Ave., Fullerton, CA 92831
(714)870-9772( )
CIWMB#: 30-C-04488

AutoZone #5522
1801 Orangethorpe W. Fullerton, CA 92833
(714)870-8286( )
CIWMB#: 30-C-06062

AutoZone #5523
102 N Euclid Fullerton, CA 92832
(714)870-8286( )
CIWMB#: 30-C-04755

EZ Lube #17
4002 N Harbor Blvd., Fullerton, CA 92835
(714)871-9980( )
CIWMB#: 30-C-03741

Firestone Store #27EH
1933 N Placentia Ave., Fullerton, CA 92831
(714)993-7100( )
CIWMB#: 30-C-02122

Fox Service Center
1018 W Orangethorpe Fullerton, CA 92833
(714)879-1430( )
CIWMB#: 30-C-02318

Fullerton College Automotive Technology
321 E Chapman Ave., Fullerton, CA 92832
(714)992-7275( )
CIWMB#: 30-C-03165

Kragen Auto Parts #0731
2978 Yorba Linda Fullerton, CA 92831
(714)996-4780( )
CIWMB#: 30-C-02628

Kragen Auto Parts #4133
904 W Orangethorpe Ave., Fullerton, CA 92832
(714)526-3570( )
CIWMB#: 30-C-06256

Pep Boys #642
1530 S Harbor Blvd., Fullerton, CA 92832
(714)870-0700( )
CIWMB#: 30-C-01755

Sunnyside 76 Car Care Center
2701 N Brea Blvd., Fullerton, CA 92835
(714)256-0773( )
CIWMB#: 30-C-01381

Garden Grove

76 Pro Lube Plus
9001 Trask Ave., Garden Grove, CA 92844
(714)393-0590( )
CIWMB#: 30-C-05276

AutoZone #5527
13190 Harbor Blvd., Garden Grove, CA 92843
(714)636-5665( )
CIWMB#: 30-C-04760

David Murray Shell
12571 Vly View St., Garden Grove, CA 92845
(714)898-0170( )
CIWMB#: 30-C-00547

Express Lube & Wash
8100 Lampson Ave., Garden Grove, CA 92841
(909)316-8261( )
CIWMB#: 30-C-06544

Firestone Store #7180
10081 Chapman Ave., Garden Grove, CA 92840
(714)530-4630( )
CIWMB#: 30-C-01224

Firestone Store #71W3
13961 Brookhurst St., Garden Grove, CA 92843
(714)590-2741( )
CIWMB#: 30-C-03690

Jiffy Lube #1991
13970 Harbor Blvd., Garden Grove, CA 92843
(714)554-0610( )
CIWMB#: 30-C-05400

Kragen Auto Parts #1251
13933 N Harbor Blvd., Garden Grove, CA 92843
(714)554-3780( )
CIWMB#: 30-C-02663

Kragen Auto Parts #1555
9851 Chapman Ave., Garden Grove, CA 92841
(714)741-8030( )
CIWMB#: 30-C-04079

Nissan of Grarden Grove
9670 Trask Ave., Garden Grove, CA 92884
(714)537-0900( )
CIWMB#: 30-C-06553

Toyota of Garden Grove
9444 Trask Ave., Garden Grove, CA 92844
(714)895-5595( )
CIWMB#: 30-C-06555

La Habra

AutoZone #5532
1200 W Imperial Hwy., La Habra, CA 90631
(562)694-5337( )
CIWMB#: 30-C-04784

Burch Ford
201 N Harbor Blvd., La Habra, CA 90631
(562)691-3225( )
CIWMB#: 30-C-05179

Firestone Store #2736
1071 S Beach Blvd., La Habra, CA 90631
(562)691-1731( )
CIWMB#: 30-C-01169

Kragen Auto Parts #1569
1621 W Whittier Blvd., La Habra, CA 90631
(562)905-2538( )
CIWMB#: 30-C-04076

Pep Boys #997
125 W Imperial Hwy., La Habra, CA 90631
(714)447-0601( )
CIWMB#: 30-C-04026

SpeeDee Oil Change & Tune-Up
1580 W Imperial Hwy., La Habra, CA 90631
(562)697-3513( )

Los Alamitos

Jiffy Lube #1740
3311 Katella Ave., Los Alamitos, CA 90720
(562)596-1827( )
CIWMB#: 30-C-03529

Midway City

Bolsa Transmission
8331 Bolsa Ave., Midway City, CA 92655
(714)799-6158( )
CIWMB#: 30-C-05768

Placentia

Advanced Auto & Diesel
144 S Bradford Placentia, CA 92870
(714)996-8222( )
CIWMB#: 30-C-06242

Castner's Auto Service
214 S. Bradford Ave., Placentia, CA 92870
(714)528-1311( )
CIWMB#: 30-C-06452

Econo Lube N' Tune
100 W Chapman Ave., Placentia, CA 92870
(714)524-0424( )
CIWMB#: 30-C-06454

Fairway Ford
1350 E Yorba Linda Blvd., Placentia, CA 92870
(714)524-1200( )
CIWMB#: 30-C-01863

Seal Beach

M & N Coastline Auto & Tire Service
12239 Seal Beach Blvd., Seal Beach, CA 90740
(714)826-1001( )
CIWMB#: 30-C-04433

Seal Beach Chevron
12541 Seal Beach Blvd., Seal Beach, CA 90740
(949)495-0774(14)
CIWMB#: 30-C-06425

Stanton

AutoZone #2806
11320 Beach Blvd., Stanton, CA 90680
(714)895-7665( )
CIWMB#: 30-C-04563

Joe's Auto Clinic
11763 Beach Blvd., Stanton, CA 90680
(714)891-7715( )
CIWMB#: 30-C-03253

Kragen Auto Parts #1742
11951 Beach Blvd., Stanton, CA 90680
(714)799-7574( )
CIWMB#: 30-C-05231

Scher Tire #20
7000 Katella Ave., Stanton, CA 90680
(714)892-9924( )
CIWMB#: 30-C-05907

USA 10 Minute Oil Change
8100 Lampson Ave., Stanton, CA 92841
(714)373-4432( )
CIWMB#: 30-C-05909

Westminster

AutoZone #5543
6611 Westminster Blvd., Westminster, CA 92683
(714)898-2898( )
CIWMB#: 30-C-04964

AutoZone #5544
8481 Westminster Blvd., Westminster, CA 92683
(714)891-3511( )
CIWMB#: 30-C-04966

City of Westminster Corporate Yard
14381 Olive St., Westminster, CA 92683
(714)895-2876(292)
CIWMB#: 30-C-02008

Honda World
13600 Beach Blvd., Westminster, CA 92683
(714)890-8900( )
CIWMB#: 30-C-03639

Jiffy Lube #1579
6011 Westminster Blvd., Westminster, CA 92683
(714)899-2727( )
CIWMB#: 30-C-02745

John's Brake & Auto Repair
13050 Hoover St., Westminster, CA 92683
(714)379-2088( )
CIWMB#: 30-C-05617

Kragen Auto Parts #0762
6562 Westminster Blvd., Westminster, CA 92683
(714)898-0810( )
CIWMB#: 30-C-02590

Midway City Sanitary District
14451 Cedarwood St., Westminster, CA 92683
(714)893-3553( )
CIWMB#: 30-C-01626

Pep Boys #653
15221 Beach Blvd., Westminster, CA 92683
(714)893-8544( )
CIWMB#: 30-C-03415

Yorba Linda

AutoZone #5545
18528 Yorba Linda Blvd., Yorba Linda, CA 92886
(714)970-8933( )
CIWMB#: 30-C-04971

Econo Lube N' Tune
22270 La Palma Ave., Yorba Linda, CA 92887
(714)692-8394( )
CIWMB#: 30-C-06513

EZ Lube Inc. #41
17511 Yorba Linda Blvd., Yorba Linda, CA 92886
(714)556-1312( )
CIWMB#: 30-C-05739

Firestone Store #27T3
18500 Yorba Linda Blvd., Yorba Linda, CA 92886
(714)779-1966( )
CIWMB#: 30-C-01222

Jiffy Lube #1532
16751 Yorba Linda Blvd., Yorba Linda, CA 92886
(714)528-2800( )
CIWMB#: 30-C-03777

Mike Schultz Import Service
4832 Eureka Ave., Yorba Linda, CA 92886
(714)528-4411( )
CIWMB#: 30-C-04313

This information was provided by the County of Orange Integrated Waste Management Department and the California Integrated Waste Management Board (CIWMB).

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

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

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

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

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

For emergencies, dial 911.

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

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Printed on Recycled Paper

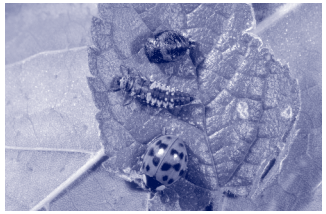
Help Prevent Ocean Pollution:

Responsible Pest Control

Tips for Pest Control

Key Steps to Follow:

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



Three life stages of the common lady beetle, a beneficial insect.

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

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

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

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

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

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

UC CE University of California Cooperative Extension

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

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

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

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

Step 4: **Wear appropriate protective clothing.**

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

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

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

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

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

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

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

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

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

Step 7: **Properly store and dispose of unused pesticides.**

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

Store unused chemicals in a locked cabinet.

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

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

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

PROJECT Pollution PREVENTION

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

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

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

UCCE Master Gardener Hotline:
(714) 708-1646

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

For emergencies, dial 911.

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

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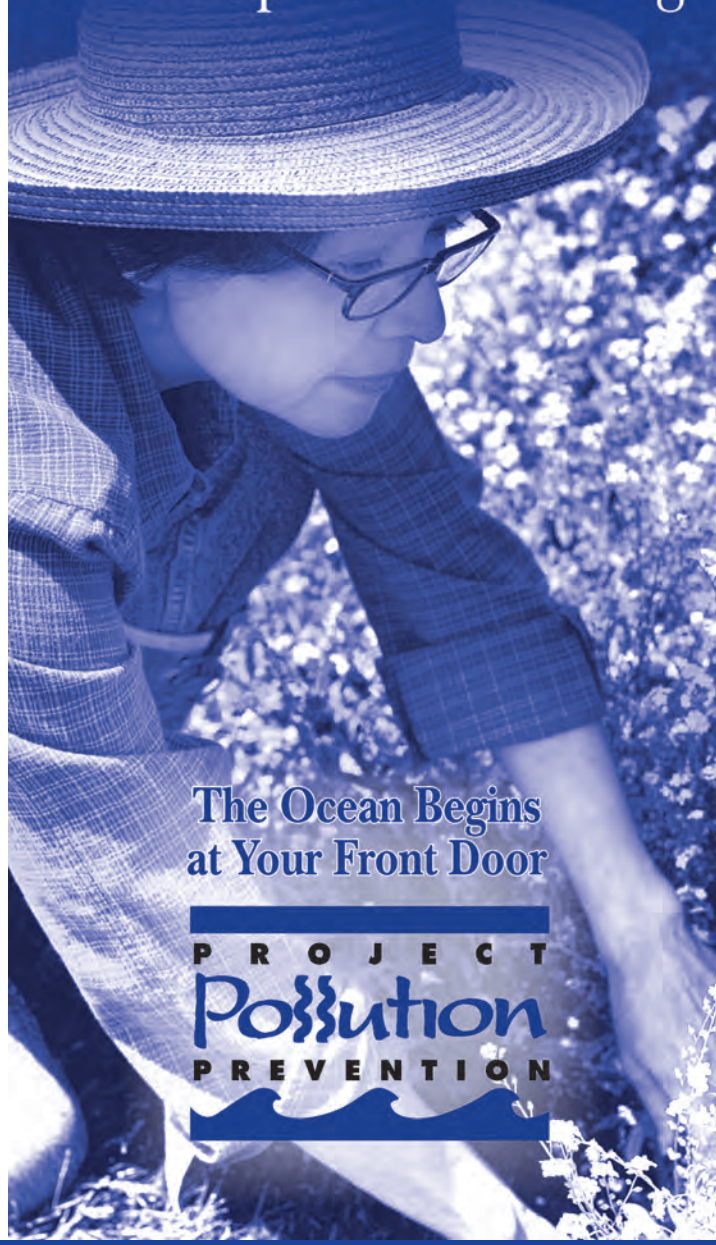
Help Prevent Ocean Pollution:

Tips for Landscape & Gardening



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Landscape & Gardening

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

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.

- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.

- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.

- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

Garden & Lawn Maintenance

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

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

- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.

- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.

- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.

- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.

- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit **www.ipm.ucdavis.edu**.

- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.

- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

Household Hazardous Waste Collection Centers

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

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

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Swimming pools and spas are common in Orange County, but they must be maintained properly to guarantee that chemicals aren't allowed to enter the street, where they can flow into the storm drains and then into the waterways. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump pool chemicals into the ocean, so don't let it enter the storm drains. Follow these easy tips to help prevent water pollution.

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

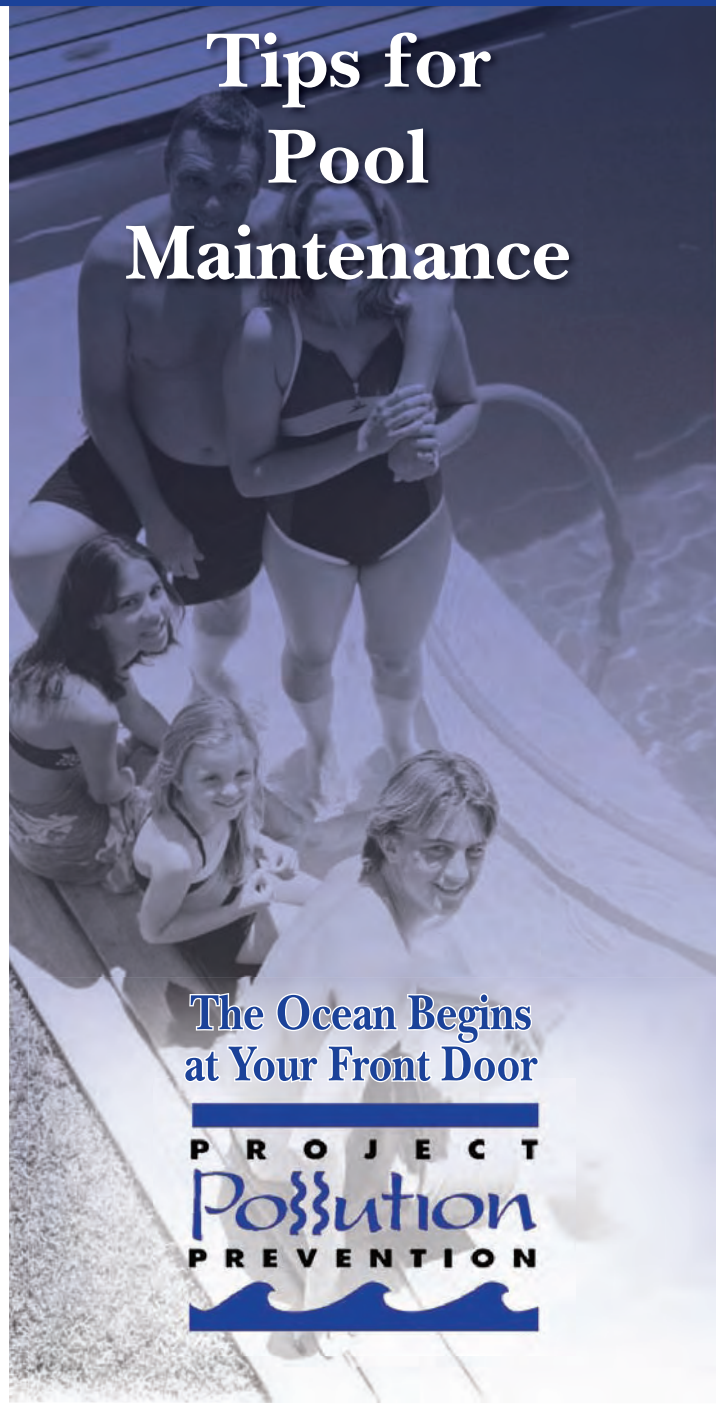
To report a spill,
call the
Orange County 24-Hour
Water Pollution Reporting Hotline
1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

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

Help Prevent Ocean Pollution:

Tips for Pool Maintenance



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Pool Maintenance

Many pools are plumbed to allow the pool to drain directly to the sanitary sewer. If yours is not, follow these instructions for disposing of pool and spa water.

Acceptable and Preferred Method of Disposal

When you cannot dispose of pool water in the sanitary sewer, the release of dechlorinated swimming pool water is allowed if all of these tips are followed:

- The residual chlorine does not exceed 0.1 mg/l (parts per million).
- The pH is between 6.5 and 8.5.
- The water is free of any unusual coloration, dirt or algae.
- There is no discharge of filter media.
- There is no discharge of acid cleaning wastes.
- Some cities may have ordinances that do not allow pool water to be disposed into a storm drain. Check with your city.

How to Know if You're Following the Standards

You can find out how much chlorine is in your water by using a pool testing kit. Excess chlorine can be removed by discontinuing the use of chlorine for a few days prior to discharge or by purchasing dechlorinating chemicals from a local pool supply company. Always make sure to follow the instructions that come with any products you use.

Doing Your Part

By complying with these guidelines, you will make a significant contribution toward keeping pollutants out of Orange County's creeks, streams, rivers, bays and the ocean. This helps to protect organisms that are sensitive to pool chemicals, and helps to maintain the health of our environment.

PROJECT Pollution PREVENTION

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

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

For emergencies, dial 911.

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

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Help Prevent Ocean Pollution:

Tips for Residential Pool, Landscape and Hardscape Drains

The Ocean Begins at Your Front Door

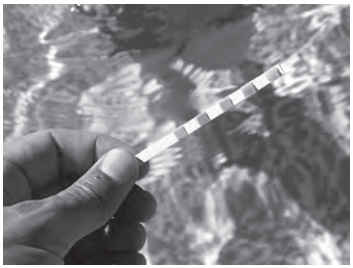
PROJECT Pollution PREVENTION

Tips for Residential Pool, Landscape and Hardscape Drains

Pool Maintenance

All pool water discharged to the curb, gutter or permitted pool drain from your property must meet the following water quality criteria:

- The residual chlorine does not exceed 0.1 mg/L (parts per million).
- The pH is between 6.5 and 8.5.
- The water is free of any unusual coloration.
- There is no discharge of filter media or acid cleaning wastes.



Some cities have ordinances that do not allow pool water to be discharged to the storm drain. Check with your city.

Landscape and Hardscape Drains

The following recommendations will help reduce or prevent pollutants from your landscape and hardscape drains from entering the street, gutter or storm drain. Unlike water that enters the sewer (from sinks and toilets), water that enters a landscape or hardscape drain is not treated before entering our creeks, rivers, bays and ocean.

Household Activities

- Do not rinse spills of materials or chemicals to any drain.
- Use dry cleanup methods such as applying cat litter or another absorbent material, then sweep it up and dispose of it in the trash. If the material is hazardous, dispose of it at a Household Hazardous Waste Collection Center (HHWCC). For locations, call **(714) 834-6752** or visit **www.oclandfills.com**.
- Do not hose down your driveways, sidewalks or patios to your landscape or hardscape drain. Sweep up debris and dispose of it in the trash.
- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash.
- Do not store items such as cleaners, batteries, automotive fluids, paint products, TVs, or computer monitors uncovered outdoors. Take them to a HHWCC for disposal.

Yard Maintenance

- Do not overwater. Water by hand or set automated irrigation systems to reflect seasonal water needs.
- Follow directions on pesticides and fertilizers (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Cultivate your garden often to control weeds and reduce the need to use chemicals.

Vehicle Maintenance

- Never pour oil or antifreeze down your landscape or hardscape drain. Recycle these substances at a service station, a waste collection center or used oil recycling center. For locations, contact the Used Oil Program at **1-800-CLEANUP** or visit **www.CLEANUP.org**.
- Whenever possible, take your vehicle to a commercial car wash.
- If you do wash your vehicle at home, do not allow the washwater to go down your landscape or hardscape drain. Instead, dispose of it in the sanitary sewer (a sink or toilet) or onto an absorbent surface such as your lawn.
- Use a spray nozzle that will shut off the water when not in use.

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, if we are not careful, our daily activities can lead directly to water pollution problems. Water that drains through your watershed can pick up pollutants which are then transported to our waterways and beautiful ocean.

You can prevent water pollution by taking personal action and by working with members of your watershed community to prevent urban runoff from entering your waterway.

For more information,
please call the
Orange County Stormwater Program
at **1.877.89.SPILL**
or visit
www.ocwatersheds.com

To report a spill,
call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline
at **1.877.89.SPILL**.

For emergencies, dial 911.

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

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Help Prevent Ocean Pollution:
Tips For Protecting Your Watershed

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Protecting Your Watershed

My Watershed. Our Ocean.

Water + shed, *noun: A region of land within which water flows down into a specified water body, such as a river, lake, sea, or ocean; a drainage basin or catchment basin.*

Orange County is comprised of 11 major watersheds into which most of our water flows, connecting all of Orange County to the Pacific Ocean.

As water from rain (stormwater) or sprinklers and hoses (urban runoff) runs down your driveway and into your neighborhood streets, sidewalks and gutters, it flows into storm drains that lead to waterways within your watershed. The waterways from other cities merge as they make their way through our watersheds until all the runoff water in Orange County meets at the Pacific Ocean. The water that reaches our ocean is not pure. As it flows through the watershed, it picks up pollutants such as litter, cigarette butts, fertilizer, pesticides, pet waste, motor oil and lawn clippings. Unlike water that enters the sewer (from sinks and toilets), water that enters the storm drain is not treated before it flows, ultimately, to the ocean.

Water quality can be improved by "Adopting Your Watershed." Through this effort, we are challenging citizens and organizations to join the Orange County Stormwater Program and others who are working to protect and restore our creeks, rivers, bays and ocean.

There are many opportunities to get involved:

- Appreciate your watershed - explore the creeks, trails and ocean and make observations about its conditions. If you see anything abnormal (such as dead fish, oil spills, leaking barrels, and other pollution) contact the Orange County 24-hour water pollution problem reporting hotline at 1.877.89.SPILL to report the problem.
- Research your watershed. Learn about what watershed you live in by visiting www.ocwatersheds.com.
- Find a watershed organization in your community and volunteer to help. If there are no active groups, consider starting your own.
- Visit EPA's Adopt Your Watershed's Catalog of Watershed Groups at www.epa.gov/adopt to locate groups in your community.
- Organize or join in a creek, river, bay or ocean cleanup event such as Coastal & Inner Coastal Cleanup Day that takes place the 3rd Saturday of every September. For more information visit www.coast4u.org.

Follow these simple tips to protect the water quality of your watershed:

- **Sweep up debris and dispose of it in the trash. Do not hose down driveways or sidewalks into the street or gutter.**
- **Use dry cleanup methods such as cat litter to absorb spills and sweep up residue.**
- **Set your irrigation systems to reflect seasonal water needs or use weather-based controllers. Inspect for runoff regularly.**
- **Cover trashcans securely.**
- **Take hazardous waste to a household hazardous waste collection center. (For example, paint, batteries and petroleum products)**
- **Pick up after your pet.**
- **Follow application and disposal directions for pesticides and fertilizers.**
- **If you wash your car at home, wash it on your lawn or divert the runoff onto a landscaped area. Consider taking your car to a commercial car wash, where the water is reclaimed or recycled.**
- **Keep your car well maintained.**
- **Never pour oil or antifreeze in the street, gutter or storm drain.**

DF-1
DRAINAGE FACILITY OPERATION AND MAINTENANCE

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and storm water that may contain certain pollutants. Consequently these pollutants may accumulate in the system and must be removed periodically. In addition, the systems must also be maintained to function properly hydraulically to avoid flooding. Maintaining the system may involve the following activities:

1. Inspection and Cleaning of Stormwater Conveyance Structures
2. Controlling Illicit Connections and Discharges
3. Controlling Illegal Dumping

This list of Model Maintenance Procedures can be utilized as an inspection checklist to determine where better compliance with Designated Minimum Best Management Practices (notated with checkmarks and capital letters) is needed, and to recommend Additional Best Management Practices (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. BMPs applicable to certain constituents are notated as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G)* *Pesticides (PEST)*
OtherToxic Compounds (TOX) *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General (ANY)*

Program/Facility Being Inspected: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

MAINTENANCE PROCEDURES:

1. Inspection and Cleaning of Drainage Facilities

Unsatisfactory	OK	General Guidelines
☐ _____	☐	T 1A. Annually inspect and clean drainage structures as needed.
☐ _____	☐	T 1B. Maintain appropriate records of cleaning and inspections.
☐ _____	☐	T 1C. Properly dispose of removed materials at a landfill or recycling facility.
☐ _____	☐	T 1D. Conduct intermittent supplemental visual inspections during the wet season to determine if there are problem inlets where sediment/trash or other pollutants accumulate, and provide for additional cleanouts as appropriate.
☐ _____	☐	T 1E. Prevent or clean up any discharges that may occur during the course of maintenance and cleaning procedures.
☐ _____	☐	T 1F. Verify that appropriate employees or subcontractors are trained in proper conductance of maintenance activities, including record keeping and disposal.
☐ _____	☐	T 1G. Annually inspect and clean v-ditches as needed, prior to the wet season. On shrub-covered slopes, vegetative debris may be placed on the downhill side of the ditch. Trash should be bagged and disposed at a landfill.

Unsatisfactory	OK	
☐	☐	
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☐	☐	

General Guidelines (cont.)

- 1a. Remove trash or debris as needed from open channels. It should be noted that major vegetative debris removal may require other regulatory permits prior to completing the work. (TRASH)
- 1b. Consider retrofitting energy dissipaters (e.g. riprap) below culvert outfalls to minimize potential for erosion. (SED)
- 1c. Repair any v-ditches that have cracked or displaced in a manner that accelerates erosion. (SED)
- 1d. If suspicious conditions appear to exist, test selected samples of the removed wastes for compliance with hazardous waste regulations prior to disposal. (TOX)
- 1e. Consider more frequent regular cleaning of selected drainage structures to help address ongoing specific impairments. (SED, BACT, NUT, TRASH)
- 1f. Consider structural retrofits to the MS4 to help address ongoing specific impairments (SED, BACT, NUT, TRASH, O&G)
- 1g. Consider cleaning out pipes at gradient breaks or other in-pipe debris accumulation points as identified/needed. (ANY, BACT, NUT, TRASH)

Storm Drain Flushing

- 1h. Flushing of storm drains or storm drain inlets should only be done when critically necessary and no other solution is practical. (SED, BACT, TRASH).
- 1i. If flushed, to the extent practical the material should be collected (vacuumed), treated with an appropriate filtering device to remove sand and debris and disposed of properly. (SED)

Waste Management

T 1H. Store wastes collected from cleaning activities of the drainage facilities in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.

- 1j. Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device to remove the sand and debris prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not permitted, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream. (SED, TRASH)
- 1k. Provide for laboratory analysis of at least one randomly collected sediment (less the debris) sample per year from the storm drain inlet leaning program to ensure that it does not meet the EPA criteria for hazardous waste. If the sample is determined to be hazardous, the sediment must be disposed of as hazardous waste and the source should be investigated. (TOX).

2. Controlling Illicit Connections and Discharges

Unsatisfactory	OK	General Guidelines
☐ _____	☐	T 2A. Report prohibited discharges such as dumping, paint spills, abandoned oil containers, etc. observed during the course of normal daily activities so they can be investigated, contained, and cleaned up.
☐ _____	☐	T 2B. Where field observations and/or monitoring data indicate significant problems, conduct field investigations to detect and eliminate existing illicit connections and improper disposal of pollutants into the storm drain (i.e. identify problem areas where discharges or illegal connections may occur and follow up stream to determine the source(s)). (Refer to Appendices A-10 and A-11.)
☐ _____	☐	T 2C. Report all observed illicit connections and discharges to the 24-hour water pollution problem reporting hotline (714) 567-6363.
☐ _____	☐	T 2D. Encourage public reporting of improper waste disposal by distributing public education materials and advertising the 24-hour water pollution problem reporting hotline.
		Storm Drain Stenciling ("No Dumping—Drains to Ocean")
☐ _____	☐	T 2E. Implement and maintain a storm drain stenciling program.
☐ _____	☐	• 2a. Consider adding the hotline number to the storm drain stencils (BACT, TOX, TRASH).

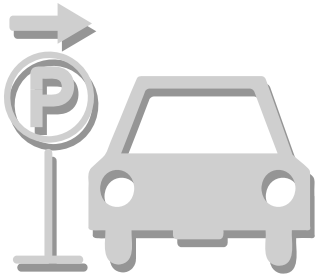
3. Controlling Illegal Dumping

		Field Investigation
☐ _____	☐	T 3A. Report prohibited discharges such as dumpings observed during the course of normal daily activities so they can be investigated, contained and cleaned up.
☐ _____	☐	T 3B. Conduct field investigations to detect and eliminate improper disposal of pollutants into the storm drain (i.e. identify problem areas where discharges or illegal connections may occur and follow up stream to determine the source(s)).
☐ _____	☐	T 3C. Report all observed illegal dumping to the 24-hour water pollution problem reporting hotline (714) 567-6363.
☐ _____	☐	T 3D. Encourage public reporting of improper waste disposal by distributing public education materials and advertising the 24-hour water pollution problem reporting hotline.
☐ _____	☐	T 3E. If perpetrator can be identified, take appropriate enforcement action.
☐ _____	☐	• 3a. Consider posting "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs could also indicate fines and penalties for illegal dumping. (ANY)

Unsatisfactory	OK	Training/Education/Outreach
☐ _____	☐	T 3F. Verify that appropriate employees and subcontractors are trained to recognize and report illegal dumping.
☐ _____	☐	T 3G. Encourage public reporting of illegal dumping by advertising the 24-hour water pollution problem reporting hotline (714) 567-6363.
☐ _____	☐	• 3b. Take extra steps to educate the public in neighborhoods where illegal dumping has occurred to inform them why illegal dumping is a problem, and that illegal dumping carries a significant financial penalty. (ANY)

LIMITATIONS:

Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.



R-3
AUTOMOBILE PARKING

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	
Bacteria	
Foaming Agents	
Metals	X
Hydrocarbons	X
Hazardous Materials	x
Pesticides and Herbicides	
Other	

Parked automobiles may contribute pollutants to the storm drain because poorly maintained vehicles may leak fluids containing hydrocarbons, metals, and other pollutants. In addition, heavily soiled automobiles may drop clods of dirt onto the parking surface, contributing to the sediment load when runoff is present. During rain events, or wash-down activities, the pollutants may be carried into the storm drain system. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before parking your car. Remember - The ocean starts at your front door.

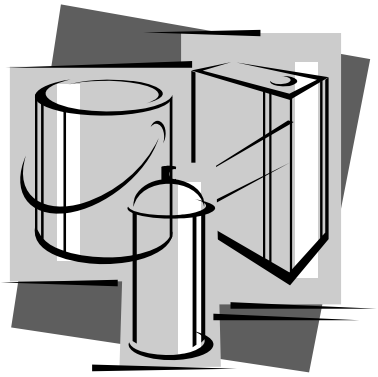
Required Activities

- If required, vehicles have to be removed from the street during designated street sweeping/cleaning times.
- If the automobile is leaking, place a pan or similar collection device under the automobile, until such time as the leak may be repaired.
- Use dry cleaning methods to remove any materials deposited by vehicles (e.g. adsorbents for fluid leaks, sweeping for soil clod deposits).

Recommended Activities

- Park automobiles over permeable surfaces (e.g. gravel, or porous cement).
- Limit vehicle parking to covered areas.
- Perform routine maintenance to minimize fluid leaks, and maximize fuel efficiency.

For additional information contact:
County of Orange, OC Watershed
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com



R-7
HOUSEHOLD HAZARDOUS WASTE

Household hazardous wastes (HHW) are defined as waste materials which are typically found in homes or similar sources, which exhibit characteristics such as: corrosivity, ignitability, reactivity, and/or toxicity, or are listed as hazardous materials by EPA.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	
Nutrients	
Bacteria	
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x

List of most common HHW products:

- Drain openers
- Oven cleaners
- Wood and metal cleaners and polishes
- Automotive oil and fuel additives
- Grease and rust solvents
- Carburetor and fuel injection cleaners
- Starter fluids
- Batteries
- Paint Thinners
- Paint strippers and removers
- Adhesives
- Herbicides
- Pesticides
- Fungicides/wood preservatives

Many types of waste can be recycled, however options for each waste type are limited. Recycling is always preferable to disposal of unwanted materials. All gasoline, antifreeze, waste oil, and lead-acid batteries can be recycled. Latex and oil-based paint can be reused, as well as recycled. Materials that cannot be reused or recycled should be disposed of at a properly permitted landfill.

Think before disposing of any household hazardous waste. Remember - The ocean starts at your front door.

RECYCLE USED OIL

Required Activities

- Dispose of HHW at a local collection facility. Call (714) 834-6752 for the household hazardous waste center closest to your area.
- Household hazardous materials must be stored indoors or under cover, and in closed and labeled containers.
- If safe, contain, clean up, and properly dispose all household hazardous waste spills. If an unsafe condition exists, call 911 to activate the proper response team.

Recommended Activities

- Use non-hazardous or less-hazardous products.
- Participate in HHW reuse and recycling. Call (714) 834-6752 for the participating household hazardous waste centers.

The California Integrated Waste Management Board has a Recycling Hotline (800) 553-2962, that provides information and recycling locations for used oil.

For additional information contact:
County of Orange, OC Watershed
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
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Site Design & Landscape Planning SD-10

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain

barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Efficient Irrigation SD-12

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Trash Storage Areas SD-32

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Appendix D

BMP Maintenance Supplement / O&M Plan

OPERATIONS AND MAINTENANCE (O&M) PLAN

Water Quality Management Plan

For

EF Costa Mesa Campus

3150 Bear St., Costa Mesa, CA 92626

APN: 141-521-48 & 141-521-49

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BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
NON-STRUCTURAL SOURCE CONTROL BMPs			
Yes	N1. Education for Property Owners, Tenants and Occupants	Educational materials will be provided to tenants upon tenant occupancy. Tenants will be provided these materials by the Owner prior to occupancy and periodically thereafter. Frequency: Upon tenant occupancy	EF Education First
Yes	N2. Activity Restrictions	The district will prescribe activity restrictions to protect surface water quality, through lease terms or other equally effective measure, for the property. Restrictions include, but are not limited to, prohibiting vehicle maintenance or vehicle washing. Frequency: Monthly	EF Education First

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Yes	N3. Common Area Landscape Management	Maintenance shall be consistent with City requirements. Fertilizer and/or pesticide usage shall be consistent with County Management Guidelines for Use of Fertilizers (OC DAMP Section 5.5) as well as local requirements. Maintenance includes mowing, weeding, and debris removal on a weekly basis. Trimming, replanting, and replacement of mulch shall be performed on an as-needed basis to prevent exposure of erodible surfaces. Trimmings, clippings, and other landscape wastes shall be properly disposed of in accordance with local regulations. Materials temporarily stockpiled during maintenance activities shall be placed away from water courses and storm drain inlets. Frequency: Yearly	EF Education First
Yes	N4. BMP Maintenance	Maintenance of structural BMPs implemented at the project site shall be performed at the frequency prescribed in this WQMP (Appendix D). Records of inspections and BMP maintenance shall be kept by the Owner and shall be available for review upon request. Frequency: Weekly	EF Education First

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Yes	N11. Common Area Litter Control	Litter patrol, violations investigations, reporting and other litter control activities shall be performed on a weekly basis and in conjunction with routine maintenance activities. Frequency: Weekly	EF Education First
Yes	N12. Employee Training	Educate all new employees/ managers on storm water pollution prevention, particularly good housekeeping practices, prior to the start of the rainy season (October 1). Refresher courses shall be conducted on an as needed basis. Frequency: Annually for all employees and within 6 months of hire date for new employees	EF Education First
Yes	N14. Common Area Catch Basin Inspection	Catch basin inlets and other drainage facilities shall be inspected after each storm event and once per year. Inlets and other facilities shall be cleaned prior to the rainy season, by October 1 each year. Frequency: Annually	EF Education First
Yes	N15. Street Sweeping Private Streets and Parking Lots	Drive aisles & parking areas must be swept at least once per month, including prior to the start of the rainy season (October 1). Frequency: Monthly	EF Education First

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX			
BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
STRUCTURAL SOURCE CONTROL BMPs			
Yes	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. Storm drain stencils shall be inspected for legibility, at minimum, once every five years. Those determined to be illegible will be re-stenciled as soon as possible. Frequency: Annually	EF Education First
No	S3. Design and construct trash and waste storage areas to reduce pollution introduction	Sweep trash area at least once per week and before October 1st each year. Maintain area clean of trash and debris at all times. Frequency: Weekly	EF Education First
Yes	S4. Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	In conjunction with routine maintenance activities, verify that landscape design continues to function properly by adjusting properly to eliminate overspray to hardscape areas, and to verify that irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, weather, and day or night time temperatures. Water from testing/flushing shall be collected and properly disposed to the sewer system and shall not discharge to the storm drain system. Frequency: Monthly	EF Education First

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX		
BMP Name and BMP Implementation, Maintenance and Inspection Procedures	**Implementation, Maintenance, and Inspection Frequency and Schedule**	**Person or Entity with Operation & Maintenance Responsibility**
LOW IMPACT DEVELOPMENT BMPs		
Biotreatment BMP: Modular Wetland Systems (MWS) Modular Wetlands by Modular Wetlands Systems, Inc. are proprietary biotreatment systems that utilize multi-stage treatment processes. 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.	Inspect system at a minimum of once every six months, prior to the start of the rainy season (October 1), and after major storm events. Typical maintenance includes removing trash & debris from the catch basin screening filter (by hand), removal of sediment and solids in the settlement chamber (vacuum truck), replacement of the BioMediaGREENTM filter cartridge, and replacement of the BioMediaGREENTM drain down filter (if equipped). In addition, plants within the wetland chamber will require trimming in conjunction with landscape maintenance activities. See attached manufacturer's specifications for additional requirements. Frequency: 2x per year	EF Education First

Required Permits

Permits are not required for the implementation, operation, and maintenance of the BMPs.

Forms to Record BMP Implementation, Maintenance, and Inspection

The form that will be used to record implementation, maintenance, and inspection of BMPs is attached.

Recordkeeping

All records must be maintained for at least five (5) years and must be made available for review upon request.

Waste Management

Any waste generated from maintenance activities will be disposed of properly. Wash water and other waste from maintenance activities is not to be discharged or disposed of into the storm drain system. Clippings from landscape maintenance (i.e. prunings) will be collected and disposed of properly off-site, and will not be washed into the streets, local area drains/conveyances, or catch basin inlets.

RECORD OF BMP IMPLEMENTATION, MAINTENANCE, AND INSPECTION

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

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

RECORD OF BMP IMPLEMENTATION, MAINTENANCE, AND INSPECTION

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

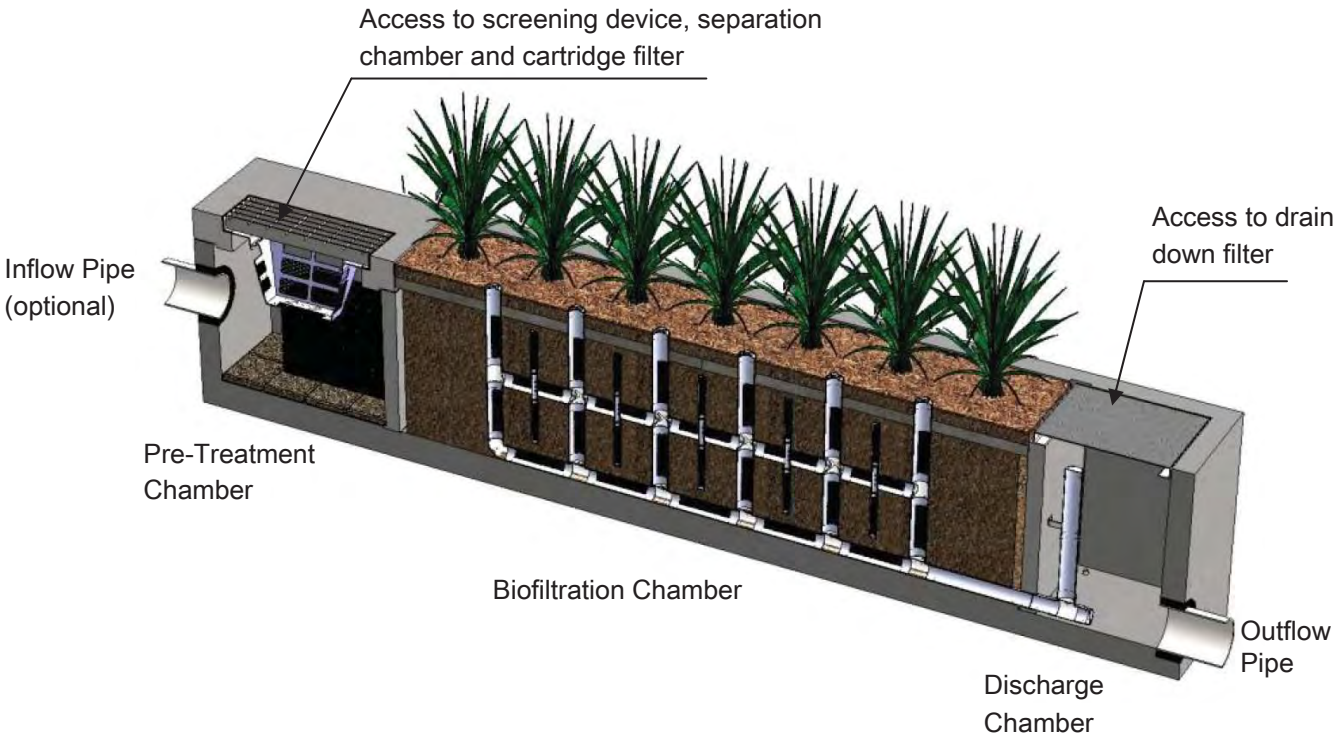
BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

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

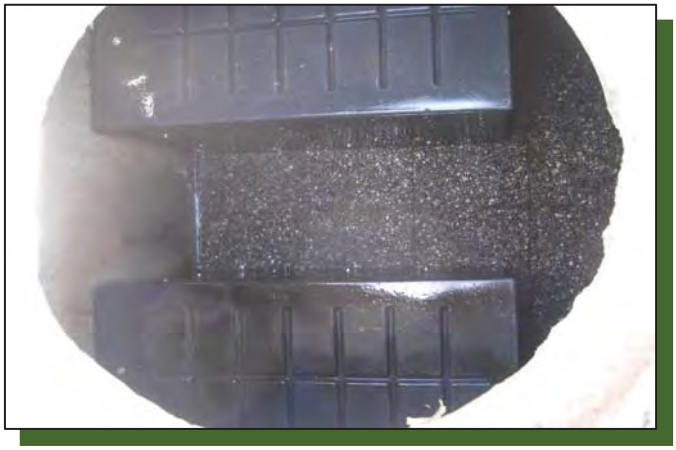
The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.

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

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

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 _____

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 ( ) –

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

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 _____

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

APPENDIX E

CONDITIONS OF APPROVAL (PENDING ISSUANCE)

Appendix F

Infiltration Test Results

GMU GEOTECHNICAL, INC.
23241 Arroyo Vista • Rancho Santa Margarita, CA 92688 • phone: 949.888.6513 • fax: 949.888.1380 • info@gmugeo.com • www.gmugeo.com

Report of Geotechnical Foundation Investigation, EF International Language Campus – New Dormitory Buildings and Site Improvements, 3150 Bear Street City of Costa Mesa, California

Prepared for EFEKTA GROUP, INC.

March 1, 2019

GMU Project No. 18-252-00

GMU GEOTECHNICAL, INC.
23241 Arroyo Vista • Rancho Santa Margarita, CA 92688 • phone: 949.888.6513 • fax: 949.888.1380 • info@gmugeo.com • www.gmugeo.com

TRANSMITTAL

EFEKTA GROUP, INC.
Two Education Circle
Cambridge, MA 02141

DATE: March 1, 2019

PROJECT: 18-252-00

ATTENTION: Ms. Bev Garth, Executive Vice President

SUBJECT: Report of Geotechnical Foundation Investigation,
EF International Language Campus
New Dormitory Buildings and Site Improvements
3150 Bear Street
City of Costa Mesa, California

DISTRIBUTION:

Addressee: electronic copy

Gensler
Attn: Mr. Tom Williams (four (4) wet signature copies and an electronic copy)

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INTRODUCTION

PURPOSE

This report presents the results of our geotechnical foundation investigation of soil and geologic conditions for the proposed three (3) dormitory buildings and site improvements located at 3150 Bear Street, City of Costa Mesa, California.

SCOPE

The scope of our geotechnical foundation investigation, as outlined in our December 20, 2018 proposal, was as follows:

1. Staked eleven (11) hollow-stem-auger, truck-mounted drill holes and four (4) cone penetration testing (CPT) soundings locations, coordinated with EFEKTA Group, Inc., and contacted Underground Service Alert (USA/Dig Alert) in order to provide advance notification of the subsurface drill holes and CPTs planned within the project site.

2. Performed a field subsurface exploration program consisting of:

    - Advanced eight (8) HSA drill holes to a maximum depth of approximately 31.5 feet, and four (4) CPTs to depths of approximately 50 feet within the footprints of the new dorm buildings. The CPTs were utilized to obtain shear wave velocities, to verify the current groundwater level and perform a liquefaction analysis.
    - Performed an additional three (3) HSA drill holes to a depth of approximately 5 feet below the existing ground surface to perform preliminary percolation testing.

    Logged all field exploration work and obtained bulk, SPT and drive soil samples for geotechnical laboratory testing.

3. Performed laboratory testing on soil samples obtained from the drill holes. Testing included moisture and density, gradation, Atterberg limits, maximum density, expansion index, shear strength characteristics, consolidation, R-value, and full chemical analysis.

4. Interpreted and evaluated the field and laboratory data collected from this investigation, and performed geotechnical engineering design analyses which included; bearing capacity and settlement analysis, liquefaction analysis, seismic analysis in accordance with the 2016 California Building Code (CBC) standards, and pavement analysis.

5. Supported the schematic design "SD" processes by providing geotechnical design memos/e-mails with geotechnical design conclusions and recommendations, which included the following:

   - Foundation design and anticipated settlement of the dorm buildings;
   - Site preparation, building foundation over-excavation, and precise grading requirements;
   - Acceptability of the site soils for use as fill and backfill;
   - Infiltration results;
   - Shrinkage and subsidence figures relative to earthwork;
   - Site seismicity and seismic design parameters;
   - Lateral earth pressures and temporary slopes;
   - Liquefaction potential and seismic settlement of the site soils;
   - Installation of underground utilities;
   - Flatwork design; and
   - Asphalt pavement and concrete pavement designs.

6. Prepared and distributed this formal geotechnical foundation report for the project, containing our final geotechnical conclusions and recommendations to support the main project submittal and permitting processes.

7. Geotechnical reviews and geotechnical response letters to the grading and building departments of our foundation investigation report, and final project precise grading and foundation plans for the project will be performed under separate covers at a later date.

LOCATION

The subject site is bound by the 405 Freeway on the north, Bear Street on the west, existing single family homes on the south, and existing single family homes on the east. The general location of the project site is shown on our Plate 1 – Location Map.

SITE DESCRIPTION

The site was previously occupied by the Trinity Broadcast Network, a 6.19 acre property containing and existing 2-story 65,650 square foot building with extensive site improvements such as existing landscape areas, Portland cement concrete and asphalt concrete pavement, concrete flatworks,

foundation areas, and miscellaneous auxiliary structures. The site is relatively flat with gentle sloping from south to north.

PROJECT DESCRIPTION

It is our understanding that The EFEKTA Group Inc., which is in escrow on the subject 6.19 acre property is planning on constructing one (1) 3-story dormitory building and two (2) 4-story dormitory buildings. The 3-story building is identified as Building No 3, and the 4-story buildings are identified as Buildings No. 1 and 2 in this report. The location of each building is identified on Plate 2 – Geotechnical Map. The improvements will also include associated drives, parking stalls, flatwork, pool, basketball, soccer and volleyball areas, landscape, and appurtenant structures.

Preliminary structural loads for the buildings were provided by Nabih Youssef Structural Engineers (NYSE). NYSE anticipates maximum building footprint loading of 600 psf (dead load) and 160 psf (live load), with columns loads on the order of 475 kips (dead + live load).

SUBSURFACE EXPLORATION

GMU conducted a subsurface exploration program to evaluate the soil conditions below the proposed dorm buildings, parking areas, and appurtenant structures. A total of fifteen (15) exploratory borings and CPTs were performed, which consisted of the following:

- Eleven (11) hollow stem auger exploratory borings to a maximum depth of 31.5 feet.
- Four (4) CPT soundings to a maximum depth of 50 feet.

The boring locations and CPTs are shown on Plate 2 – Geotechnical Map. Boring logs are contained in Appendix A-1. The hollow stem auger borings were logged by our Staff Engineer, with emphasis on obtaining deep samples up to 31.5 feet below the ground surface. Samples were collected in each of the borings for subsequent laboratory testing. The CPT logs are also contained in Appendix A-1.

LABORATORY TESTING

Laboratory testing was performed on bulk and relatively undisturbed samples collected from the exploratory borings during our recent subsurface exploration. Testing on soil samples included the following:

- Moisture and density
- Sieve analysis and hydrometer
- Atterberg limits
- Expansion index
- Maximum density
- Consolidation
- Direct shear tests
- R-value
- Corrosion (pH, resistivity, chlorides, soluble sulfates)

The results of our laboratory testing are summarized on Table B-1 and included within Appendix B-1 – Laboratory Testing.

GEOLOGIC FINDINGS

REGIONAL GEOLOGIC SETTING

The site is located within the northwestern portion of the Peninsular Ranges Province and the southern portion of the Los Angeles Basin Block, approximately 2.8 miles east of the Santa Ana River and approximately 2.5 miles northeast of the Newport Inglewood Fault. It is underlain by Holocene and Late Pliocene axial channel deposits (Morton et al., 2004).

SUBSURFACE MATERIALS

Topsoil

Top soils were encountered in all of our exploratory drill holes. The topsoil was approximately 1 foot in thickness.

Artificial Fill (Qaf)

Artificial fill was not observed during drilling; however, based on surface observations, site history, and existing site conditions, it is likely that the upper 1 to 2 feet of soil has been disturbed or reworked or deeper fills exist in vicinity of existing improvements. It is anticipated that these soils will be soft to firm, damp to moist, and consist of materials similar to the Young Alluvial Deposits. These soils will not be suitable for support of the planned improvements.

Young Alluvial Deposits (Qya)

Young alluvial deposits underlie the fill material and extended to the maximum depth of the exploratory drill holes. The young alluvial deposits consist of moist to wet, firm to stiff clay and silt material, and moist to very moist, medium dense to very dense sand materials.

GROUNDWATER

Groundwater was encountered at depths ranging from 18 to 20 feet below the existing grade. The historic high depth to groundwater is reportedly 10 to 30 feet below the existing grade at the project site. Groundwater conditions may vary across the site due to stratigraphic and hydrologic conditions, and may change over time as a consequence of seasonal and meteorological fluctuations, or activities by humans at this site and nearby sites. Groundwater is unlikely to impact the proposed development, however, very moist to wet/saturated clayey soils should be expected even in shallow excavations.

GEOLOGIC HAZARDS

FAULTING AND SEISMICITY

The subject site is not within an Alquist-Priolo Earthquake Fault Zone, and no known active faults are shown on current geologic maps as crossing the site. However, the site is located within close proximity of several surface faults that are presently zoned as active or potentially active by the California Geological Survey (CGS). The nearest known active faults are the San Joaquin Hills Blind Thrust and Newport-Inglewood Fault Zone, which are located about 0.4 mile and 5.0 miles from the site, respectively.

Most of southern California is subject to some level of ground shaking (ground motion) because of movement along active and potentially active fault zones in the region. Several sizeable, historic earthquakes have occurred in southern California. Given the proximity of the site to several active and potentially active faults, the site will likely be subject to earthquake ground motions in the future. The level of ground motion at a given site resulting from an earthquake is a function of several factors including earthquake magnitude, type of faulting, rupture propagation path, distance from the epicenter, earthquake depth, duration of shaking, site topography, and site geology.

Seismic Hazard Zones

The subject is located within an area mapped as having the potential for seismically induced liquefaction but not landsliding, as shown on the Seismic Hazard Zone Map for Newport Beach Quadrangle (CGS, 1997).

LIQUEFACTION & EARTHQUAKE-INDUCED SETTLEMENTS

Liquefaction

A liquefaction evaluation was performed on each CPT by means of CLiq, v.1.7.6.49 software and the Robertson (2009) methodology. The analysis was based on the 2016 CBC and ASCE 7-10 criteria. During our recent field exploration, groundwater was encountered at a depth of approximately 18 feet below the existing grade. However, according to the California Geological Survey (CDMG, 197), historic high groundwater is reportedly at a depth between 10 and 30 feet below the existing grade. A historic high groundwater depth of 10 feet was used in the analysis.

The results of our analysis indicate liquefaction does occur in discrete zones below a depth of 24 feet. Seismic settlement related to liquefaction along with dry sand seismic settlement was also calculated for the site. The analysis indicates seismic settlements on the order of 1.5 inches below Building No.1 and 0.5 inch beneath Buildings No. 2 and 3. The results of the liquefaction and earthquake-induced settlement analyses are included in the attached Appendix C.

LANDSLIDES

Based on our review of available geologic maps, literature, topographic maps, aerial photographs, and our subsurface evaluation, no landslides or related features underlie or are adjacent to the subject site. Due to the relatively level nature of the site and surrounding areas, the potential for landslides to occur at the project site is considered negligible.

TSUNAMI, SEICHE, AND FLOODING

The site is not located on any State of California – County of Orange Tsunami Inundation Map for Emergency Planning. The potential for the site to be adversely impacted by earthquake-induced tsunamis is considered to be negligible because the site is located several miles inland from the Pacific Ocean coast at an elevation exceeding the maximum height of potential tsunami inundation.

The potential for the site to be adversely impacted by earthquake-induced seiches is considered to be negligible due to the lack of any significant enclosed bodies of water located in the vicinity of the site.

According to the County of Orange FEMA Flood Insurance Rate Map, the site is located within "Zone", an area of 0.2% annual chance flood, 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile, and protected by levees from 1% annual chance flood. The potential for the site to be adversely impacted by significant flooding is considered low.

GEOTECHNICAL ENGINEERING FINDINGS

STATIC SETTLEMENT/COMPRESSIBILITY

Engineered Fills and Alluvial Deposits

Static settlement of the site will be induced by introducing new building loads to existing grades and subsurface soils. The underlying alluvial deposits encountered were found to be firm to stiff and medium dense to very dense, however, the upper approximately 30 feet of the site are considered susceptible to significant consolidation upon loading. The static settlement at the site was analyzed under our recommended bearing capacity utilizing the approximate preliminary building foundation loads provided by the structural engineer by means of our consolidation laboratory tests for the site. The magnitude of total static settlements beneath Building No. 1 and No. 2 is expected to be approximately 2 inches and beneath Building No. 3 to be approximately 1.75 inches.

FOUNDATION SYSTEMS

Based on the static/compressibility characteristics of the on-site alluvial soils, the results of the liquefaction hazard analysis, we recommend that Building No. 1 be supported on a mat foundation system, while Buildings No. 2 and 3 be supported on either a mat foundation or shallow spread footing foundation system supported on rammed aggregate piers.

SOIL EXPANSION

Based on our expansion index testing, the near-surface materials have a ***high to very high expansion potential***. Although portions of the alluvial soils encountered were relatively coarse-grained, the majority of alluvial soils encountered were fine-grained and expansive. Additional expansion index

testing is recommended below the proposed improvements upon completion of precise grading and prior to construction.

SOIL CORROSION

The results of the laboratory chemical tests performed on representative samples collected within the site indicate the following:

- A high sulfate exposure to concrete or an "S2" exposure in accordance with ACI Table19.3.2.1.
- A high chloride content (corrosive to ferrous metals).
- A low level of resistivity, which indicates that the soil is severely corrosive to ferrous metals.

The results of the laboratory chemical tests performed within the site are included in Appendix B.

PRELIMINARY PERCOLATION TESTING

Three (3) preliminary percolation tests were performed in general conformance with the Santa Ana Regional Water Quality Control Board Technical Guidance Document (TGD), Appendices dated March 2011. The "Shallow Percolation" test procedure contained in Section VII.3.8 was utilized. The percolation borings were drilled to a maximum depth of 5 feet below the existing grade using a hollow-stem-auger, truck-mounted drill rig. The calculated infiltration rates are presented in the table below.

Calculated Infiltration Rates

Drill Hole	Depth Below Finish Grade (feet)	Infiltration Rate (inches/hour)*
DH-3	4.92	0.02
DH-7	5.0	0.02
DH-9	5.0	0.01

**Rates incorporate a factor of safety of 2.*

The calculated infiltrate rates do not meet the minimum requirement of 0.3 inches/hour per the TGD manual. On this basis, infiltration of storm water into the site soils is deemed not feasible.

EXCAVATION CHARACTERISTICS

Rippability

The majority of the soil materials underlying the site can be excavated with scrapers and other conventional grading equipment.

IN-SITU SOIL MOISTURE CHARACTERISTICS

The fill and alluvial soils within the site are generally moist to very moist, and at certain locations wet. Fill and alluvial soils within the upper 7 feet have an average degree of saturation of more than 85%. It should be noted, however, that the moisture content within the upper several feet may vary depending on rainfall and the time of year in which grading occurs. Consequently, one or more of the following measures during remedial grading may be required: 1) locally drying back of the soils, and/or 2) mixing of the soils with cement to reduce the expansive nature and very moist to wet nature of the onsite soils.

SUMMARY OF CONCLUSIONS

Based on the geologic and geotechnical findings, the following is a summary of our conclusions:

1. It is our opinion that the proposed project is feasible assuming all applicable recommendations contained herein are implemented.
2. The proposed 4-story Building No. 1 may be supported on a mat foundation, while the proposed 4 and 3-story Buildings No. 2 and 3 may be supported on a mat foundation or shallow spread footings supported on rammed aggregate piers.
3. Groundwater is not anticipated to directly impact the planned precise grading or during the installation of shallow underground utilities.
4. There are no known active faults crossing the subject site. The site seismicity is typical for the Irvine area. Structure design should be in accordance with the current CBC.
5. The magnitude of total seismic settlement beneath Building No. 1 is expected to be on the order of 1.5 inches and beneath Buildings No. 2 and 3 on the order of 0.5 inch.
6. The magnitude of total static settlements beneath Building No. 1 and 2 is expected to be less than 2.0 inch, and the magnitude of total static settlement beneath Building No. 3 is expected to be less than 1.75 inches, provided that the corrective grading and/or ground improvement recommendations are performed during construction.
7. Due to the potential for highly expansive soils, special design considerations will be required for the flatwork associated with the proposed improvements, and for the slab-on-grade within Buildings No. 2 and 3, if a mat foundation is not selected.

8. The on-site soils are severely corrosive to ferrous metals and have a potential for severe sulfate and chloride corrosion exposure to concrete (i.e., as defined by the CBC) and reinforcement. Special design considerations will be required for proposed improvements in contact with on-site soil.
9. Based on preliminary percolation testing and calculated infiltration rates, infiltration of storm water into the site soils is deemed not feasible.
10. The fill and alluvial soils within the site are found to be in a moist to very moist condition, while some locations containing wet soil conditions. Ground mitigation is anticipated during the grading process.

RECOMMENDATIONS

SEISMIC DESIGN OF THE PROPOSED BUILDINGS

Site-specific seismic design parameters were determined using the USGS computer program title ASCE 7 Hazard Tool. The site coordinates used in the analysis were 33.6868° North Latitude and 117.8912° West Longitude. Based on our field exploration and the site soil profile, the site should be designated as Site Class D based on the measured shear wave velocities at CPT-1, CPT-2, and CPT-4, resulting in V_{S30} of 895 feet/sec, 845 feet/sec, and 910 feet/sec respectively. The seismic design coefficients based on ASCE 7-10 and 2016 CBC are listed in table below.

2016 CBC Site Categorization and Site Coefficients

Categorization/Coefficient	Design Value
Site Class based on Soil Profile (ASCE 7, Table 20.3-1)	D
Short Period Spectral Acceleration S_s**	1.562
1-sec. Period Spectral Acceleration S_1**	0.577
Site Coefficient F_a (Table 11.4-1)**	1.000
Site Coefficient F_v (Table 11.4-2)**	1.500
Short Period MCE* Spectral Acceleration S_{MS}**	1.562
1-sec. Period MCE Spectral Acceleration S_{M1}**	0.865
Short Period Design Spectral Acceleration S_{DS}**	1.041
1-sec. Period Design Spectral Acceleration S_{D1}**	0.577
MCE Peak Ground Acceleration (PGA) *	0.604
Site Coefficient F_{PGA} (Table 11.8-1)**	1.000
MCE Peak Ground Acceleration (PGA_M) *	0.604
Modal Contributing Magnitude to MCE Event	6.6

* *MCE: Maximum Considered Earthquake*
** *Values Obtained from USGS Earthquake Hazards Program website are based on the ASCE7-10 and 2016 CBC.*

The Maximum Considered Earthquake (MCE) Peak Horizontal Ground Acceleration (PHGA) is 0.60g as determined in accordance with the 2016 CBC. This PHGA is primarily dominated by earthquakes with a modal magnitude of 6.6 at a mean distance of 8.2 miles from the site using the USGS 2014 Interactive Deaggregation website.

It should be recognized that much of southern California is subject to some level of damaging ground shaking as a result of movement along the major active (and potentially active) fault zones that characterize this region. Design utilizing the 2016 CBC is not meant to completely protect against damage or loss of function. Therefore, the preceding parameters should be considered as minimum design criteria.

GENERAL SITE PREPARATION AND GRADING (EXCLUDING BUILDING AREAS)

General

All site preparation and grading outside the building areas should be performed in accordance with the City of Irvine grading code requirements and the recommendations presented in this report.

Clearing

All significant organic material such as weeds, brush, tree branches, roots, construction debris, old irrigation lines, or other decomposable material should be removed from areas to be graded.

Corrective Grading (Within Building Areas)

Removal and re-compaction of soils within building areas will be required to provide a stable platform for construction of proposed foundations and to limit static settlement.

The corrective grading should be conducted to the satisfaction of the soils technician to ensure that the subgrade soils are thoroughly mixed and that all significant organics (roots, wood debris, etc.) that could decompose with time and cause settlement are removed.

It should be noted that the recommendations provided herein are based on our subsurface exploration and knowledge of the on-site geology. Actual removals may vary in configuration and volume based on observations of geologic materials and conditions encountered during grading. The bottom of all remedial grading removals should be observed by a GMU representative to verify the suitability of in-place soils prior to performing the scarification and recompaction. General remedial grading recommendations are outlined below.

Buildings No. 1 and 2 – Supported on Mat Foundation

Given the saturated in-place soil conditions, the presence of highly expansive soil, the relatively soft subgrade and associated seismic settlement, a mat foundation system with subgrade mitigation may be used to support the proposed 4-story Buildings No. 1 and 2. We recommend that the mat foundation be supported on 5 feet of cement treated soil. Grading recommendations for the proposed Buildings No. 1 and 2 foundation should consist of the following:

- The mat foundation should be excavated to a depth of at least 5 feet below bottom of the mat foundation. The lateral extent of the overexcavation should be at least 5 feet beyond the edge of the mat.
- The bottom of the excavation should then be scarified to a depth of at least 8 inches, mixed with 6% cement, moisture conditioned to 1-3% above optimum moisture content, and recompacted to at least 92% relative compaction.
- The onsite material mixed with 6% cement may then be used as fill material to achieve the planned mat foundation bottom elevation. The fill material mixed thoroughly with cement should be placed in 6- to 8-inch-thick lifts, moisture conditioned to 1-3% above optimum moisture content, and compacted to achieve 92% relative compaction.

Building No. 3 – Supported on Mat Foundation

Given the saturated in-place soil conditions, the presence of highly expansive soil, the relatively soft subgrade and associated seismic settlement, a mat foundation system with subgrade mitigation may be used to support the proposed 3-story Building No. 3. We recommend that the mat foundation be supported on 3 feet of cement treated soil. Grading recommendations for the proposed Building No. 3 foundation should consist of the following:

- The mat foundation should be excavated to a depth of at least 3 feet below bottom of the mat foundation. The lateral extent of the overexcavation should be at least 3 feet beyond the edge of the mat.
- The bottom of the excavation should then be scarified to a depth of at least 8 inches, mixed with 6% cement, moisture conditioned to 1-3% above optimum moisture content, and recompacted to at least 92% relative compaction.
- The onsite material mixed with 6% cement may then be used as fill material to achieve the planned mat foundation bottom elevation. The fill material mixed thoroughly with cement should be placed in 6- to 8-inch-thick lifts, moisture conditioned to 1-3% above optimum moisture content, and compacted to achieve 92% relative compaction.

Buildings No. 2 and 3 – Supported on Geopiers or Equivalent Gravel Piers

If shallow spread footings supported on Geopiers or equivalent gravel piers are selected to support Buildings No. 2 and 3, then the slab-on-grade (SOG) subgrade will require corrective grading prior

to construction of the slab structural section. Grading for Buildings No. 2 and 3 SOG should consist of the following:

- The SOG subgrade should be excavated to a depth of at least 18 inches below bottom of the slab section (i.e., bottom of the aggregate base).
- The bottom of the excavation should then be scarified to a depth of at least 6 inches, mixed with approximately 6% cement, moisture conditioned to 1-3% above optimum moisture content, and recompacted to at least 92% relative compaction.
- The onsite material mixed with 6% cement may then be used as fill material to achieve the planned SOG subgrade elevation. The fill material mixed thoroughly with cement should be placed in 6- to 8-inch-thick lifts, moisture conditioned to 1-3% above optimum moisture content, and compacted to achieve 92% relative compaction.

We note, a soil cement mix design should be performed to evaluate the required amount of cement to achieve a minimum 7-day unconfined compressive strength of 300 psi. Based on the soil types encountered, we anticipate that 6% cement will be sufficient to achieve the design strength.

Corrective Grading (Outside Building Areas)

Removal and re-compaction of areas to receive new improvements that are outside the buildings areas will be required for adequate performance relative to expansive soil uplift.

The corrective grading should be conducted to the satisfaction of the soils technician to ensure that the subgrade soils are thoroughly mixed and that all significant organics (roots, wood debris, etc.) that could decompose with time and cause settlement are removed.

It should be noted that the recommendations provided herein are based on our subsurface exploration and knowledge of the on-site geology. Actual removals may vary in configuration and volume based on observations of geologic materials and conditions encountered during grading. The bottom of all remedial grading removals should be observed by a GMU representative to verify the suitability of in-place soils prior to performing the scarification and recompaction. General remedial grading recommendations are outlined below.

<u>Vehicular Pavement:</u> Grading recommendations for the new vehicular pavement areas should consist of the following:

- The vehicular pavement section should be over-excavated to a depth of at least 12 below the bottom of the pavement section (i.e., 12 inches below the bottom of the aggregate base).
- The bottom of the over-excavation should then be scarified to a depth of at least 6 inches, moisture conditioned to least 4% above optimum moisture content, and recompacted to at least 90% relative compaction.

- Following the approval of the over-excavation bottom by a representative of GMU, the onsite material may be used as fill material to achieve the planned subgrade elevation.
- The fill material should then be placed in 6- to- 8-inch-thick lifts, moisture conditioned to at least 4% above optimum moisture content, and compacted to achieve 90% relative compaction.

Retaining Walls: Grading recommendations for the retaining wall foundation should consist of the following:

- The retaining wall foundation should be over-excavated to a depth of at least 18 below the bottom of footing.
- The bottom of the over-excavation should then be scarified to a depth of at least 6 inches, moisture conditioned to least 4% above optimum moisture content, and recompacted to at least 90% relative compaction.
- Following the approval of the over-excavation bottom by a representative of GMU, the onsite material may be used as fill material to achieve the planned subgrade elevation.
- The fill material should then be placed in 6- to- 8-inch-thick lifts, moisture conditioned to at least 4% above optimum moisture content, and compacted to achieve 90% relative compaction.

Flatwork/Hardscape/Sports Court/Pool Shell and Deck: Grading recommendations for the new concrete flatwork/hardscape/sports court/pool area and deck should consist of the following:

- The flatwork/hardscape/sports court/pool shell and deck section should be over-excavated to a depth of at least 12 inches below the bottom of the hardscape/flatwork/sports court/pool shell and deck section (i.e., 12 inches below the bottom of the aggregate base).
- The bottom of the over-excavation should then be scarified to a depth of at least 6 inches, moisture conditioned to least 4% above optimum moisture content, and recompacted to at least 90% relative compaction.
- Following the approval of the over-excavation bottom by a representative of GMU, the onsite material may be used as fill material to achieve the planned subgrade elevation.
- The fill material should then be placed in 6- to- 8-inch-thick lifts, moisture conditioned to at least 4% above optimum moisture content, and compacted to achieve 90% relative compaction.

Additional Grading Recommendations

If the existing loose fill materials are found to be disturbed to depths greater than the proposed remedial grading, the depth of excavation, scarification, and re-compaction should be increased accordingly in local areas as recommended by representative of the Geotechnical Engineer of Record. In addition, if soft and unstable subgrade are encountered, they should be stabilized in accordance with the ***Subgrade Stabilization*** section of this report. The Geotechnical Engineer of

Record should observe these conditions in the field and provide site-specific recommendations based on their observation.

FILL MATERIAL AND PLACEMENT

Suitability and Selective Grading

All on-site soil materials within the limits of grading are suitable for use as compacted fill if care is taken to remove all significant organic and other decomposable debris, to separate and selectively place and/or stockpile rock materials larger than 6 inches in diameter, and to dry back the material to the 4% above optimum moisture content.

Compaction Standard and Moisture Requirements

All on-site soil material used as compacted fill, or material processed in place or used to backfill trenches, should be moistened, dried, or blended as necessary to achieve a minimum of 4% over optimum moisture content for compaction, and densified to at least 90% relative compaction as determined by ASTM Test Method D 1557. Final surface subgrade soils should be frequently watered in order to keep the soil moist until building slabs, flatwork, or any other final improvements are installed. If the soil is allowed to dry out and deep shrinkage cracks appear, at least the upper foot should be re-processed, moisture conditioned to 4% over optimum, and compacted.

Use of Rock or Broken Concrete

No rock or broken concrete greater than 6 inches in diameter should be utilized in the fills.

SUBGRADE STABILIZATION

Based on the observed moisture content, there is a potential to encounter moist to wet, soft subgrade soils in the proposed pavement/flatwork/hardscape areas. If soft subgrade soils are encountered, remedial measures would be required to stabilize the subgrade prior to placement of the vehicular pavement and/or the flatwork/hardscape section. The measures to stabilize the subgrade should consist of the following:

- Removal of the unstable soils to a depth of approximately 12 inches below the top of the unstable material, placement of geotextile material (Mirafi RS580i or equivalent) followed by placement of approximately 12 inches of Crushed Aggregate Base (CAB) or Crushed Miscellaneous Base (CMB) to replace the unstable soil that was removed.

- The thickness of the aggregate base will depend on the amount of Aggregate Base (AB) or Crushed Miscellaneous Base (CMB) required to create a stable platform. The recommended depth of remediation (i.e., approximately 12 inches for the geogrid/aggregate base replacement) could be greater or less, depending on the conditions encountered.

- The bottom of the excavation should be left relatively undisturbed prior to placement of the geotextile. Upon placement of the geotextile, the CAB or CMB should then be placed in a 1-foot-thick lift and compacted to 90% relative compaction.

- A representative of GMU should observe the excavation bottom prior to utilizing this mitigation method.

TEMPORARY EXCAVATIONS

Temporary excavations for demolitions, earthwork, footings, and utility trenches are expected. We anticipate that unsurcharged excavations with vertical side slopes less than 4 feet high will generally be stable. Our recommendations for temporary excavations are as follows:

- Temporary, unsurcharged excavation sides over 4 feet in height to maximum allowable slopes excavation of 20 feet should be sloped based on a Type B soil in accordance with OSHA requirements.
- Where sloped excavations are created, the tops of the slopes should be barricaded so that vehicles and storage loads do no encroach within 10 feet of the tops of the excavated slopes. A greater setback may be necessary when considering heavy vehicles, such as concrete trucks and cranes. GMU should be advised of such heavy vehicle loadings so that specific setback requirements can be established.
- If the temporary construction slopes are to be maintained during the rainy season, berms are recommended to be graded along the tops of the slopes in order to prevent runoff water from entering the excavation and eroding the slope faces.

Our temporary excavation recommendations are provided only as **minimum** guidelines. All work associated with temporary excavations should meet the minimal requirements as set forth by CALOSHA. Temporary slope construction, maintenance, and safety are the responsibility of the contractor.

BUILDING NO. 1 RECOMMENDATIONS

The following recommendations apply for design and construction of Building No. 1 proposed at the far north side of the property.

Preliminary Mat Foundation Design Parameters

- The preliminary design parameters presented below may be used for foundation structural design.
  - Bearing Material: Cement Treated Soil (See Corrective Grading Section)
    - Removal and Re-compaction Depth: 5 feet below bottom of footings
  - Minimum Mat Foundation:
    - Based on our correspondence with the project structural engineer and provided preliminary loading, and based on an estimated building foot print dimension of 45 feet by 280 feet, we estimate that the building load distributed uniformly over the mat foundation footprint may induce an approximate uniform pressure of 760 psf for dead plus live loads.
  - Assumed Minimum Thickness: 24 inches
    - Final mat foundation thickness shall be determined by the structural engineer.
  - Allowable Bearing Capacity:
    - Based on the assumptions made above, the mat foundation estimate approximate uniform pressure of 760 psf can be also taken as the allowable bearing capacity. However, for localized loading conditions, a maximum allowable bearing pressure of 3,000 psf may be used.
  - Above value may be increased by 1/3 for temporary loads such as wind and seismic

- Settlement:
  - For the purpose of preparing this preliminary settlement estimate, we have assumed a uniform bearing pressure of 760 psf under the mat slab.
  - Static Settlement:
    - Total: 2.0 inch
    - Differential: 1.0 inch over a span of 40 feet
  - Seismic Settlement:
    - Total : 1.5 inches
    - Differential: 1.0 inch over a span of 40 feet

- Modulus of Subgrade Reaction (k):
  - 200 pci (static)
  - This value assumes that the mat foundation subgrade is treated with cement

- Lateral Foundation Resistance:
    - Allowable passive resistance: 500 psf/ft (disregard upper 6 inches, max 5,000 psf)
    - Allowable friction coefficient: 0.35
    - These values assumes that the mat foundation subgrade is treated with cement.
    - Above values may be combined without reduction and may be increased by 1/3 for temporary loads such as wind or seismic

The mat slab should be designed by the project structural engineer. ***In addition, in order to finalize the mat foundation recommendations, we recommend that the structural engineer model the mat foundation with all anticipated point loads utilizing the provided Modulus of Subgrade Reaction (k) in this section, and provide this office with the analyses, including bearing pressure and settlement contour under the slab.***

BUILDING NO. 2 RECOMMENDATIONS

The following recommendations apply for design and construction of Building No. 2 proposed at the west side of the property. The proposed building may be supported on either on Option A) a mat foundation with cement treated soil, or Option B) shallow spread footings supported on rammed aggregate piers and a structural slab.

Building No. 2: Option A – Mat Foundation

Preliminary Mat Foundation Design Parameters

- The preliminary design parameters presented below may be used for foundation structural design.
  - Bearing Material: Cement Treated Soil ***(See Corrective Grading Section)***
    - Removal and Re-compaction Depth: 5 feet below bottom of footings
  - Minimum Mat Foundation:
    - Based on our correspondence with the project structural engineer and provided preliminary loading, and based on an estimated building foot print dimension of 47 feet by 219 feet, we estimate that the building load distributed uniformly over the mat foundation footprint may induce an approximate uniform pressure of 760 psf for dead plus live loads.
  - Assumed Minimum Thickness: 24 inches
    - Final mat foundation thickness shall be determined by the structural engineer.
  - Allowable Bearing Capacity:
    - Based on the assumptions made above, the mat foundation estimate approximate uniform pressure of 760 psf can be also taken as the allowable bearing capacity. However, for localized loading conditions, a maximum allowable bearing pressure of 3,000 psf may be used.
  - Above value may be increased by 1/3 for temporary loads such as wind and seismic
- Settlement:
  - For the purpose of preparing this preliminary settlement estimate, we have assumed a uniform bearing pressure of 760 psf under the mat slab.

- Static Settlement:
  - Total: 2.0 inch
  - Differential: 1.0 inch over a span of 40 feet
- Seismic Settlement:
  - Total : 0.5 inches
  - Differential: 0.25 inches over a span of 40 feet

- Modulus of Subgrade Reaction (k):
  - 200 pci (static)
  - This value assumes that the mat foundation subgrade is treated with cement

- Lateral Foundation Resistance:
  - Allowable passive resistance: 500 psf/ft (disregard upper 6 inches, max 5,000 psf)
  - Allowable friction coefficient: 0.35
  - These values assumes that the mat foundation subgrade is treated with cement.
  - Above values may be combined without reduction and may be increased by 1/3 for temporary loads such as wind or seismic

The mat slab should be designed by the project structural engineer. ***In addition, in order to finalize the mat foundation recommendations, we recommend that the structural engineer model the mat foundation with all anticipated point loads utilizing the provided Modulus of Subgrade Reaction (k) in this section, and provide this office with the analyses, including bearing pressure and settlement contour under the slab.***

<u>Building No. 2: Option B – Shallow Spread Footings with Rammed Aggregate Piers</u>

Recommended Shallow Spread Footings Design Scheme

We recommend that shallow spread footings be supported on rammed aggregate piers and the slab-on-grade (SOG) be designed for expansion potential and settlement. The SOG may be designed by either the WRI or PTI method.

Geopiers or Equivalent Gravel Piers

Based on the site conditions, it is our opinion that Geopiers or equivalent gravel piers supported shallow spread/continuous foundation systems may be used for support of the proposed Building No. 2. The allowable bearing capacity provided by the Geopier or equivalent system is typically up to 5,000 psf, which result in smaller size of shallow foundations based on our assumed structural loads. The gravel piers are anticipated to be 24 inches in diameter and embedded on the order of 13 to 15 below the bottom of the footing. We recommend that once a generalized foundation plan is developed, we review the applicability of Geopier-supported foundations at this site. If suitable

based on the structural loading conditions, Geopier-supported foundations could be a cost-effective solution for structure support, which should be designed by the specialty contractor.

Special Expansive Soil Mitigation Slab Design

If Geopiers or equivalent gravel piers are selected to support the proposed building foundations, the SOG should be designed for both expansion potential and settlement in accordance with either the WRI or PTI methods. Design parameters for the proposed slab-on-grade are discussed in the following sections:

Deepened Slab Edge. The perimeter slab footing should extend a minimum of 36 inches below the lowest adjacent grade to act as a moisture cut-off. The edge footing should be a minimum of 12 inches wide. Minimum reinforcement should consist of two #5 bars both top and bottom. In addition, all utilities going into the building should have their permeable backfill zones sealed with either sand-cement slurry or cementious grout.

Perimeter Structural Stiffening. The perimeter of the building slab should be designed to accommodate expansive soil movements that may occur due to the existence of the planters. The slabs may be designed by either the WRI or PTI method. Recommendations are presented below for slabs supported on cement treated soil:

WRI Methodology
- Cw = 15
- PI = 25

PTI Methodology

Edge Lift:	e_m = 4.5’/y_m = 1.05”
Center Lift (edge drop):	e_m = 8.9’ / y_m = 0.25”
Modulus of Subgrade Reaction:	100 pci

The slab deflection should be designed such that the deflection will be compatible with the structure and overlying improvements. This should be coordinated with the architect.

In addition, the following recommendations should be implemented and/or considered:

- Surface drainage in the planters adjacent to the building should be robust (i.e., with adequate fall and redundant drainage inlets).
- A perimeter French drain should be considered around the outside edge of the foundations. The drain should consist of a 4-inch-diameter perforated pipe wrapped in ¾-inch rock wrapped in filter fabric. The perforated pipe should outlet into area drains or other suitable outlet points.

Slab Subgrade and Slab Design

Perimeter Portion of Slabs. The perimeter of the slabs shall be rationally designed based on the criteria in the previous section.

Interior Portion of Slabs. The interior portion of the slab should be a minimum of 5 inches thick and be reinforced with No. 4 bars placed 18 inches on center. Final design and jointing layout and details should be provided to our office by the design structural engineer.

Slab Subsection. The entire building slab-on-grade should be founded on a moisture vapor retarder in accordance with the recommendations provided in the ***Moisture Vapor Transmission*** section of this report. Capillary break below the retarder is not required. Sand above the moisture retarder/barrier is not required from a geotechnical standpoint. This should be provided by the structural engineer.

BUILDING NO. 3 RECOMMENDATIONS

The following recommendations apply for design and construction of Building No. 3 proposed at the east side of the property. The proposed building may be supported on either on Option A) a mat foundation with cement treated soil, or Option B) shallow spread footings supported on rammed aggregate piers and a structural slab.

Building No. 3: Option A – Mat Foundation

Preliminary Mat Foundation Design Parameters

- The preliminary design parameters presented below may be used for foundation structural design.
  - Bearing Material: Cement Treated Soil ***(See Corrective Grading Section)***
    - Removal and Re-compaction Depth: 3 feet below bottom of footings
  - Minimum Mat Foundation:
    - Based on our correspondence with the project structural engineer and provided preliminary loading, and based on an estimated building foot print dimension of 47 feet by 219 feet, we estimate that the building load distributed uniformly over the mat foundation footprint may induce an approximate uniform pressure of 600 psf for dead plus live loads.
  - Assumed Minimum Thickness: 24 inches
    - Final mat foundation thickness shall be determined by the structural engineer.

- Allowable Bearing Capacity:
  - Based on the assumptions made above, the mat foundation estimate approximate uniform pressure of 600 psf can be also taken as the allowable bearing capacity. However, for localized loading conditions, a maximum allowable bearing pressure of 3,000 psf may be used.
- Above value may be increased by 1/3 for temporary loads such as wind and seismic

- Settlement:
  - For the purpose of preparing this preliminary settlement estimate, we have assumed a uniform bearing pressure of 600 psf under the mat slab.
  - Static Settlement:
    - Total: 1.75 inch
    - Differential: 1.0 inch over a span of 40 feet
  - Seismic Settlement:
    - Total : 0.5 inches
    - Differential: 0.25 inches over a span of 40 feet

- Modulus of Subgrade Reaction (k):
  - 200 pci (static)
  - This value assumes that the mat foundation subgrade is treated with cement

- Lateral Foundation Resistance:
  - Allowable passive resistance: 500 psf/ft (disregard upper 6 inches, max 5,000 psf)
  - Allowable friction coefficient: 0.35
  - These values assumes that the mat foundation subgrade is treated with cement.
  - Above values may be combined without reduction and may be increased by 1/3 for temporary loads such as wind or seismic

The mat slab should be designed by the project structural engineer. ***In addition, in order to finalize the mat foundation recommendations, we recommend that the structural engineer model the mat foundation with all anticipated point loads utilizing the provided Modulus of Subgrade Reaction (k) in this section, and provide this office with the analyses, including bearing pressure and settlement contour under the slab.***

<u>Building No. 3: Option B – Shallow Spread Footings with Rammed Aggregate Piers</u>

Recommended Shallow Spread Footings Design Scheme

We recommend that the spread footings be supported on rammed aggregate piers and the slab-on-grade (SOG) be designed for expansion potential and settlement. The SOG may be designed by either the WRI or PTI method.

Geopiers or Equivalent Gravel Piers

Based on the site conditions, it is our opinion that Geopiers or equivalent gravel piers supported shallow spread/continuous foundation systems may be used for support of the proposed Building No. 3. The allowable bearing capacity provided by the Geopier or equivalent system is typically up to 5,000 psf, which result in smaller size of shallow foundations based on our assumed structural loads. The gravel piers are anticipated to be 24 inches in diameter and embedded on the order of 11 to 13 below the bottom of the footing. We recommend that once a generalized foundation plan is developed, we review the applicability of Geopier-supported foundations at this site. If suitable based on the structural loading conditions, Geopier-supported foundations could be a cost-effective solution for structure support, which should be designed by the specialty contractor.

Special Expansive Soil Mitigation Slab Design

If Geopiers or equivalent gravel piers are selected to support the proposed building foundations, the SOG should be designed for both expansion potential and settlement in accordance with either the WRI or PTI methods. Design parameters for the proposed slab-on-grade are discussed in the following sections:

Deepened Slab Edge. The perimeter slab footing should extend a minimum of 36 inches below the lowest adjacent grade to act as a moisture cut-off. The edge footing should be a minimum of 12 inches wide. Minimum reinforcement should consist of two #5 bars both top and bottom. In addition, all utilities going into the building should have their permeable backfill zones sealed with either sand-cement slurry or cementious grout.

Perimeter Structural Stiffening. The perimeter of the building slab should be designed to accommodate expansive soil movements that may occur due to the existence of the planters. The slabs may be designed by either the WRI or PTI method. Recommendations are presented below for slabs supported on cement treated soil:

WRI Methodology
- Cw = 15
- PI = 25

PTI Methodology

Edge Lift:	e_m = 4.5’/y_m = 1.05”
Center Lift (edge drop):	e_m = 8.9’ / y_m = 0.25”
Modulus of Subgrade Reaction:	100 pci

The slab deflection should be designed such that the deflection will be compatible with the structure and overlying improvements. This should be coordinated with the architect.

In addition, the following recommendations should be implemented and/or considered:

- Surface drainage in the planters adjacent to the building should be robust (i.e., with adequate fall and redundant drainage inlets).
- A perimeter French drain should be considered around the outside edge of the foundations. The drain should consist of a 4-inch-diameter perforated pipe wrapped in ¾-inch rock wrapped in filter fabric. The perforated pipe should outlet into area drains or other suitable outlet points.

Slab Subgrade and Slab Design

Perimeter Portion of Slabs. The perimeter of the slabs shall be rationally designed based on the criteria in the previous section.

Interior Portion of Slabs. The interior portion of the slab should be a minimum of 5 inches thick and be reinforced with No. 4 bars placed 18 inches on center. Final design and jointing layout and details should be provided to our office by the design structural engineer.

Slab Subsection. The entire building slab-on-grade should be founded on a moisture vapor retarder in accordance with the recommendations provided in the ***Moisture Vapor Transmission*** section of this report. Capillary break below the retarder is not required. Sand above the moisture retarder/barrier is not required from a geotechnical standpoint. This should be provided by the structural engineer.

POLE FOUNDATIONS

It is expected that the shade structures and light poles will be supported on pole foundations. As a minimum, the pole foundations should be at least 18 inches in diameter and at least 4 feet deep; however, the actual dimensions should be determined by the project structural engineer based on the following design parameters.

Bearing Materials. The pole foundations may bear into engineered fill soils or competent native soils approved by a representative from GMU.

Bearing Values. End-bearing capacity and skin friction may be combined to determine the allowable bearing capacities of the pole foundations. An allowable bearing pressure of 3,250 pounds per square foot (psf) may be used for pole foundations at least 18 inches in diameter and embedded a minimum of 4 feet below the lowest adjacent grade. A value of 180 pounds per square foot may be used to determine the skin friction between the concrete and surrounding fill.

Lateral Load Design. Lateral loads may be resisted by passive resistance within the adjacent earth materials. For passive resistance, an allowable passive earth pressure of 200 pounds per foot of pile diameter per foot of depth into competent bearing material may be used; however, passive resistance should be disregarded within the upper foot due to possible disturbance during drilling. The passive resistance value may be applied over an area equivalent to two pile diameters.

RETAINING WALL DESIGN AND CONSTRUCTION CRITERIA

The following criterion is considered applicable to the design and construction of retaining walls at the subject site. The design assumes a maximum 6-foot-high retaining wall (i.e., from top of footing to top of retaining portion of wall) with level backfill conditions. In addition, the design assumes the use of on-site select backfill in accordance with Plate 3 – Retaining Wall Construction Detail.

Foundation Design Parameters:

Minimum Foundation Width:	12 inches
Minimum Foundation Depth:	Depth below lowest adjacent grade to bottom of footing: o 24 inches
Bearing Materials:	Engineered fill
Allowable Bearing Capacity:	2,000 psf for footing on level ground o 1/3 increase for wind or seismic conditions
Allowable Coefficient of Friction:	0.30
Unit Weight of Backfill:	125 pcf
Allowable Passive Earth Pressure:	225 psf/ft of depth (static) o Disregard upper 6 inches o Reduce passive by one-third when combined with friction in sliding resistance o 1/3 increase for seismic conditions

Wall Design Parameters:

Active Earth Pressure:	45 pcf – level backfill (Assumes the use of select soils in backfill zone)
Weight of Backfill:	125 pcf

Control/Construction Joints:	As a minimum, maximum spacing of 15 feet and at angle points
Waterproofing:	The back side of all retaining walls should be waterproofed down to the top of the foundation prior to placing subdrains or backfill. The design and selection of the waterproofing system is outside the scope of our report and is outside our purview.
Concrete:	Type V cement with 0.45 w/c ratio (geotechnical perspective only).
Wall Backfill and Drainage:	See Retaining Wall Construction Detail Diagram and Notes (shown on Plate 3) for backfill and drainage requirements.

The unrestrained (active) values are applicable when the walls are designed and constructed as cantilevered walls allowing sufficient wall movement to mobilize active pressure conditions. This wall movement should not be less than 0.01 H (H = height of wall) for the unrestrained values to be applicable.

Provided that the retaining walls have a maximum height of less than 6 feet, the current 2016 CBC indicates that the incorporation of seismic earth pressures is not required.

STRUCTURAL CONCRETE

Laboratory tests indicate that the onsite soils are classified as having a “severe” sulfate exposure and “S2” sulfate exposure category per ACI 318-14, Table 19.3.1.1. For structural features that will be in direct contact with the site soils at depth, the type of Portland cement, water to cement ratio, and the concrete compressive strength should be in accordance with ACI 318-14, Table 19.3.2.1.
Wet curing of the concrete per ACI Publication 308 is also recommended.

The aforementioned recommendations in regards to concrete are made from a soils perspective only. Final concrete mix design is beyond our purview. All applicable codes, ordinances, regulations, and guidelines should be followed in regard to the designing a durable concrete with respect to the potential for sulfate exposure from the on-site soils and/or changes in the environment.

FERROUS METAL CORROSION

The results of the laboratory chemical tests performed on a sample of soil collected within the site indicate that the on-site soils are severely corrosive to ferrous metals. Consequently, metal

structures which will be in direct contact with the soil (i.e., underground metal conduits, pipelines, metal sign posts, etc.) and/or in close proximity to the soil (wrought iron fencing, etc.) may be subject to corrosion. The use of special coatings or cathodic protection around buried metal structures has been shown to be beneficial in reducing corrosion potential. Additional provisions will be required to address high chloride contents of the soil per the 2016 CBC to protect the concrete reinforcement. The laboratory testing program performed for this project does not address the potential for corrosion to copper piping. In this regard, a corrosion engineer should be consulted to perform more detailed testing and develop appropriate mitigation measures (if necessary).

The laboratory testing program performed for this project does not address the potential for corrosion to copper piping. In this regard, a corrosion engineer should be consulted to perform more detailed testing and develop appropriate mitigation measures (if necessary). The above discussion is provided for general guidance in regards to the corrosiveness of the on-site soils to typical metal structures used for construction. Detailed corrosion testing and recommendations for protecting buried ferrous metal and/or copper elements are beyond our purview. If detailed testing is required, a corrosion engineer should be consulted to perform the testing and develop appropriate mitigation measures.

MOISTURE VAPOR TRANSMISSION

Moisture Vapor Retarder

A vapor retarder or barrier such as Stego 15 Mil Class A or equivalent should be utilized beneath the slab. The retarder/barrier should be installed as follows:

- Below moisture-sensitive floor areas.
- Installed per manufacture's specifications as well as with all applicable recognized installation procedures such as ASTM E1643-98.
- Joints between the sheets and the openings for utility piping should be lapped and taped. If the barrier is not continuously placed across footings/ribs, the barrier should, as a minimum, be lapped into the sides of the footings/rib trenches down to the bottom of the trench.
- Punctures in the vapor barrier should be repaired prior to concrete placement.

A capillary break is not required. Also, sand and/or the amount of sand above the moisture vapor retarder should be specified by the owner. The selection of sand above the retarder is not a geotechnical engineering issue and is hence outside our purview.

Water Vapor Transmission Discussion

The placement of a moisture vapor retarder below all slab areas is recommended where moisture sensitive flooring will be placed. It should be noted that the moisture retarder is intended only to reduce moisture vapor transmissions from the soil beneath the concrete and is consistent with the current standard of the industry in building construction in Southern California. It is not intended to provide a "waterproof" or "vapor proof" barrier or reduce vapor transmission from sources above the retarder (i.e., concrete). Sources above the retarder include any sand placed on top of the retarder (i.e., to be determined by the project structural designer) and from the concrete itself (i.e., vapor emitted during the curing process). The evaluation of water vapor from any source and its effect on any aspect of the proposed building space above the slab (i.e., floor covering applicability, mold growth, etc.) is outside our purview and the scope of this report.

Floor Coverings

Prior to the placement of flooring, the floor slabs should be properly cured and tested to verify that the water vapor transmission rate (WVTR) is compatible with the flooring requirements.

SURFACE DRAINAGE

Surface drainage should be carefully controlled during and after grading to prevent ponding and uncontrolled runoff adjacent to building structures and/or other properties. Particular care will be required during grading to maintain slopes, swales, and other erosion control measures needed to direct runoff toward permanent surface drainage facilities. Positive drainage of at least 2% away from the perimeters of the structures and site pavements should be incorporated into the design. In addition, it is recommended that nuisance water be directed away from the perimeter of the structures by the use of area drains in adjacent landscape and flatwork areas and roof drains tied into the site storm drain system.

BIORETENTION AREAS

We recommend that an impermeable liner be installed at the bottom and sides of all bioretention areas at the subject site to prevent vertical and lateral water migration into the adjacent structures and pavements.

UTILITY TRENCH BACKFILL CONSIDERATIONS

General

New utility line pipelines should be backfilled with both select bedding materials beneath and around the pipes and compacted soil above the pipe bedding. Recommendations for the types of the materials to be used and the proper placement of these materials are provided in the following sections:

Pipe Bedding

The pipe bedding materials should extend from at least 6 inches below the pipes to at least 12 inches above the crown of the pipes. Pipe bedding should consist of either clean sand with a sand equivalent (SE) of at least 30 or crushed rock. If crushed rock is used, it should consist of ¾-inch crushed rock that conforms to Table 200-1.2.1 (A) of the 2018 "Greenbook." Pipe bedding should also meet the minimum requirements of the County of Orange. If the requirements of the County are more stringent, they should take precedence over the geotechnical recommendations. Sufficient laboratory testing should be performed to verify the bedding meets the minimum requirements of the Greenbook and City of Irvine grading code.

Based on our subsurface exploration and knowledge of the onsite materials, the soils that will be excavated from the pipeline trenches will not meet the recommendations for pipe bedding materials; therefore, imported materials will be required for pipe bedding.

Granular pipe bedding material having a sand equivalent of 30 or greater should be properly placed in thicknesses not exceeding 3 feet, and then sufficiently flooded or jetted in place.

Crushed rock, if used, should be capped with filter fabric (Mirafi 140N, or equivalent) to prevent the migration of fines into the rock.

Trench Backfill

All existing soil material within the limits of the pipeline alignment are considered suitable for use as trench backfill above the pipe bedding zone if care is taken to remove all significant organic and other decomposable debris, moisture condition the soil materials as necessary, and separate and selectively place and/or stockpile any inert materials larger than 6 inches in maximum diameter.

Imported soils are not anticipated for backfill since the on-site soils are suitable. However, if imported soils are used, the soils should consist of clean, granular materials with physical and chemical characteristics similar to those described herein for on-site soils. Any imported soils to be used as backfill should be evaluated and approved by GMU prior to placement.

Soils to be used as trench backfill should be moistened, dried, or blended as necessary to achieve a minimum of 4% over optimum moisture content for compaction, placed in loose lifts no greater than 8 inches thick, and mechanically compacted/densified to at least 90% relative compaction as determined by ASTM Test Method D 1557. Jetting is not permitted in this trench zone.

No rock or broken concrete greater than 6 inches in maximum diameter should be utilized in the trench backfills.

SPORTS COURT DESIGN RECOMMENDATIONS

General

Due to the site being underlain by highly expansive soils, it is recommended that the basketball court be designed using a post-tensioned mat slab in accordance with the following parameters.

Soil Bearing Pressure and Modulus of Subgrade Reaction

Allowable Bearing Value:	1,500 psf
Coefficient of Friction:	0.30
Modulus of Subgrade Reaction:	75 pci

Sub-Slab Section

Pre-saturation Depth:	18 inches below design subgrade at a minimum of 4% over optimum moisture content to the satisfaction of the geotechnical engineer.

Minimum Requirements

Foundation Type:	Post-tensioned mat slab.
Slab Thickness:	Per Structural Engineer (5-inch-thick minimum)
Edge Beam Thickness:	12 inches from top of slab.

Slab Pre-stressing

The project structural engineer should utilize a high pre-stress amount such that stresses are maintained throughout the slab system. This is especially critical for the large spans of basketball courts where stress losses due to subgrade friction can result in the total loss of stress within the center regions of the slab.

Calculations should be performed by the structural engineer for the PT slab that show that all pre-stress losses have been accounted for and that there will be sufficient residual stress remaining in the slab. In this regard, the slab design by the structural engineer should provide for a minimum residual compressive stress throughout the slab of between 125 and 150 psi.

Slab Subgrade Friction

To decrease the amount of subgrade friction, it is recommended that the mat slab be placed on a double moisture vapor retarder/barrier system as described in the subsequent section. The PT design engineer should determine an appropriate friction coefficient value expected to be effective during tendon stressing.

Vapor Retarder/Barrier

- The moisture vapor retarder system should consist of a Stegowrap 15 mil or equivalent should be placed.
- A capillary break is not required. Consequently, sand is not required to be placed below the moisture vapor retarder/barrier system from a geotechnical perspective.
- The need for sand/crushed rock and/or the amount of sand/crushed rock above the moisture vapor retarder should be specified by the structural engineer or post-tension designer.

SWIMMING POOL DESIGN CRITERIA

The proposed shell and deck for the swimming pool should be designed for high to very expansive soil conditions and be in minimum accordance with Plate 4 – Pool Deck Detail For Expansive Soil Sites and Plate 5 – Swimming Pool Design Criteria. Highly expansive, severely corrosive, and severe levels of sulfate conditions should be considered in the design. The swimming pool excavation will expose expansive subgrade soils that will require pre-saturation and grading in accordance with the ***Corrective Grading*** section of this report.

Pool Bottom

It is expected that the pool bottom will rest entirely on engineered fill material in accordance with the grading recommendations in this report.

Plumbing

Leakage from the spa or from any of the appurtenant plumbing could create adverse saturated conditions of the surrounding subgrade soils. Localized areas of over-saturation can lead to differential settlement or expansion (heave) of the subgrade soils and subsequent raising and shifting of concrete flatwork. Therefore, it is essential that all plumbing fixtures be absolutely leak-free. For similar reasons, drainage from deck areas should be directed to local area drains and/or graded earth swales designed to carry runoff water to the adjacent street.

Although the pool excavation may be free of water at the time of construction, future irrigation could result in the development of perched water zones which could affect subsurface improvements. Heavy-duty pipes and flexible couplings should be used for the pool plumbing system to minimize leaking which may produce additional pressures on the pool shell. In addition, installation of a pressure valve in the pool bottom should be used to mitigate any potential buildup of pressure.

PAVEMENT DESIGN CONSIDERATIONS

General

It is expected that the driveways within the site will be constructed with both asphalt pavement and Portland cement concrete. Therefore, recommendations for both types of pavement areas are provided in the following sections. In order to accommodate fire truck and trash truck loading, a traffic index (T.I.) of 5.5 has been assumed for the drive areas.

Asphalt Pavement Design

Based on the R-value test results, an R-value of 8 was used for the design. The following pavement thicknesses should be anticipated:

Location	R-Value	Traffic Index	Asphalt Concrete (in.)	Aggregate Base* (in.)
Driveways	8	5.5	4.0	9.0
Parking Stalls	8	4.0	3.0	6.0

** assumed R-Value = 78*

The above design sections will be verified based on additional testing performed at the completion of future precise grading of the specific locations.

The planned pavement structural sections should consist of aggregate base materials (AB) and asphalt concrete materials (AC) of a type meeting the minimum City of Costa Mesa standards. The subgrade soils should be moisture conditioned to a minimum 4% above the optimum moisture content to a depth of at least 18 inches, and compacted to 90% relative compaction. The AB and AC should be compacted to at least 95% relative compaction.

Portland Cement Concrete Pavement Design

Driveways, vehicular drives, and appurtenant concrete paving, such as trash receptacle bays, will require Portland cement concrete (PCC) pavement. Assuming a T.I. of 6 to 7, a design section of 8 inches of PCC over 6 inches AB should be adequate. PCC vehicular pavement should be designed in accordance with the City of Costa Mesa standards and the requirements presented on the concrete flatwork table within the ***Concrete Flatwork Design Considerations*** section of this report.

CONCRETE FLATWORK DESIGN CONSIDERATIONS

Due to the highly expansive nature of the on-site soils, we recommend that the subgrade for the subject concrete flatwork be moisture conditioned to 4% over optimum to a depth of 18 inches below finish grade and compacted to 90% relative compaction. A 6-inch-thick section of Class 2 aggregate base (AB) or crushed miscellaneous base (CMB) should then be placed on the compacted subgrade soils, brought to 2% above optimum moisture condition, and compacted to 95% relative compaction prior to placement of walkway and patio flatwork reinforcing steel and concrete. For flatwork concrete underlain by aggregate base, Type V cement may be used.

The Concrete Flatwork Table below summarizes our flatwork recommendations:

Concrete Flatwork Table

Description	Subgrade Preparation (1)	Aggregate Base (Class 2 or CMB) (2)	Minimum Concrete Thickness	Cut-Off Barrier or Edge Thickness	Reinforcement(3)	Joint Spacing (Maximum)	Concrete(5)
Concrete Sidewalks and Walkways(4)	4% over optimum to 18 inches at 90% relative compaction	6-inch-thick section at 95% relative compaction	4 inches	Not Required	No. 3 bars @ 18”o.c.b.w. and dowel into building and curb using 9-inch Speed Dowels @ 18"o.c	5-foot x 5-foot using 9-inch speed dowels with No. 3 bars @ 18" o.c. (6)	Type V
Concrete Patios(4)	4% over optimum to 18 inches at 90% relative compaction	6-inch-thick section at 95% relative compaction	5 inches	Where adjacent to landscape areas – 12” from adjacent finish grade. Minimum of 8” width.	No. 3 bars @ 18”o.c.b.w. and dowel into building and curb using 9-inch Speed Dowels @ 18"o.c	5-foot x 5-foot using 9-inch speed dowels with No. 3 bars @ 18" o.c. (6)	Type V
Concrete Driveways(4)	4% over optimum to 18 inches at 90% relative compaction	6-inch-thick section at 95% relative compaction	8 inches	Where adjacent to landscape areas – 16” from adjacent finish grade. Minimum of 8” width.	No. 4 bars @ 18”o.c.b.w. and dowel into building and curb using 9-inch Speed Dowels @ 18"o.c	10-foot x 10-foot using 9-inch speed dowels with No. 3 bars @ 18" o.c. (6)	Type V

(1) The moisture content and compaction of the subgrade must be verified by the geotechnical consultant prior to base placement.
(2) For pedestrian usages only, S.E. 30 sand may be used instead of Aggregate Base.
(3) Reinforcement to be placed in the middle of the recommended concrete section.
(4) Where flatwork is adjacent to a stucco surface, a ¼” to ½” foam separation/expansion joint should be used.
(5) The site has severe levels of sulfates as defined by CBC. Concrete mix designs shall be selected by the concrete designer such that sulfate attack mitigation is balanced with shrinkage crack control. Concrete mix design is outside the geotechnical engineer’s purview.
(6) If dowels are placed in cored holes, the core holes shall be placed at alternating in-plane angles (i.e., not cored straight into the slab.

RECYLED PCC MATERIAL

The use of stockpiled in-place recycled PCC and crushed miscellaneous base (CMB) for new engineered fill subgrade and for the crushed miscellaneous base (CMB) under new asphalt concrete pavement and hardscape will require GMU to conduct conformance laboratory testing of representative samples of the pulverized recycled concrete pavement to confirm that the samples meet the 2018 Greenbook Section 200-2.4 standards for Crushed Miscellaneous Base (CMB). GMU recommends that this recycled CMB may be used as engineered fill for exterior subgrade structural support of new asphalt concrete and hardscape improvements outside of the building envelopes. The recycled concrete pavement is not to be used as compacted fill for support under any of the building areas or in the planters on the subject site.

PLANTERS AND TREES

Where new trees or large shrubs are to be located in close proximity of new concrete flatwork, rigid moisture/root barriers should be placed around the perimeter of the flatwork to at least 12 inches in depth in order to offer protection to the adjacent flatwork against potential root and moisture damage. Existing mature trees near flatwork areas should also incorporate a rigid moisture/root barrier placed at least 2 feet in depth below the top of the flatwork.

PLAN REVIEW / GEOTECHNICAL TESTING DURING GRADING / FUTURE REPORTS

Plan Review

Our office should review the final approved precise grading plans and landscape plans for the site and comment on the anticipated effects of any major changes from the plan reviewed for this report. In addition, the final office building foundation plans and final foundation loads will need to be reviewed to confirm that settlements are within tolerable limits.

FUTURE SERVICES

GMU should review the final construction plans to confirm they are consistent with our recommendations provided in this report.

Geotechnical Testing

It is recommended that geotechnical observation and testing be performed by GMU during the following stages of precise grading and construction:

- During site clearing and grubbing.
- During removal of any buried irrigation lines or other subsurface structures.
- During all phases of precise grading including over-excavation, temporary excavations, removals, scarification, ground preparation, moisture conditioning, proof-rolling, over-excavation, and placement and compaction of all fill materials.
- During installation of all conventional foundations and floor slab elements.
- During backfill of structure walls and underground utilities.
- During pavement section placement and compaction.
- When any unusual conditions are encountered.

LIMITATIONS

All parties reviewing or utilizing this report should recognize that the findings, conclusions, and recommendations presented represent the results of our professional geological and geotechnical engineering efforts and judgements. Due to the inexact nature of the state of the art of these professions and the possible occurrence of undetected variables in subsurface conditions, we cannot guarantee that the conditions actually encountered during grading and foundation installation will be identical to those observed and sampled during our study or that there are no unknown subsurface conditions which could have an adverse effect on the use of the property. We have exercised a degree of care comparable to the standard of practice presently maintained by other professionals in the fields of geotechnical engineering and engineering geology, and believe that our findings present a reasonably representative description of geotechnical conditions and their probable influence on the grading and use of the property.

Because our conclusions and recommendations are based on a limited amount of current and previous geotechnical exploration and analysis, all parties should recognize the need for possible revisions to our conclusions and recommendations during grading of the project. Additionally, our conclusions and recommendations are based on the assumption that our firm will act as the geotechnical engineer of record during grading of the project to observe the actual conditions exposed, to verify our design concepts and the grading contractor's general compliance with the project geotechnical specifications, and to provide our revised conclusions and recommendations should subsurface conditions differ significantly from those used as the basis for our conclusions and recommendations presented in this report.

Detailed corrosion testing and recommendations for protecting buried ferrous metal and/or copper elements are beyond our purview.

This report has not been prepared for use by other parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

CLOSURE

We are pleased to present the results of our geotechnical foundation investigation for this project. The Plates and Appendices that complete this report are listed in the Table of Contents.

If you have any questions concerning our findings or recommendations, please do not hesitate to contact us and we will be happy to discuss them with you.

Respectfully submitted,

GMU GEOTECHNICAL, INC.

REGISTERED PROFESSIONAL ENGINEER
NADIM T. SUNNA
C 84197
CIVIL
STATE OF CALIFORNIA

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David R. Atkinson
Senior Engineer/Project Manager

Reviewed By:

Gregory P. Silver, M.S., P.E., G.E.
President/Principal Engineer

ns/18-252-00 (03-01-2019)

REFERENCES

SITE-SPECIFIC REFERENCES

Conceptual Grading Plan, EF International Language Campus, Costa Mesa, prepared by Fuscoe Engineering for Gensler, dated March 1, 2019.

TECHNICAL REFERENCES

California Building Standards Commission and International Conference of Building Officials, 2016, *2016 California Building Code.*

CDMG Staff, 1997, Seismic Hazard Zone Report for the Anaheim and Newport Beach 7.5-Minute Quadrangles, Orange County, California, Seismic Hazard Zone Report 03.

CGS, 1997, Earthquake Zones of Required Investigation, Newport Beach Quadrangle, dated April 17, 1997.

Pradel, D., 1998, *Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils*, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 124, No. 4, pgs. 364-368.

Santa Ana Regional Water Quality Control Board Technical Guidance Document (TGD), Appendix 7 – *Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations,* dated December 2013.

Skempton, A. W., 1986, *Standard Penetration Test Procedures and the effects in Sands of Overburden Pressure, Relative Density, Particle Size, Ageing, and Overconsolidation,* Geotechnique, Volume 36, No. 3, September 1, 1986.

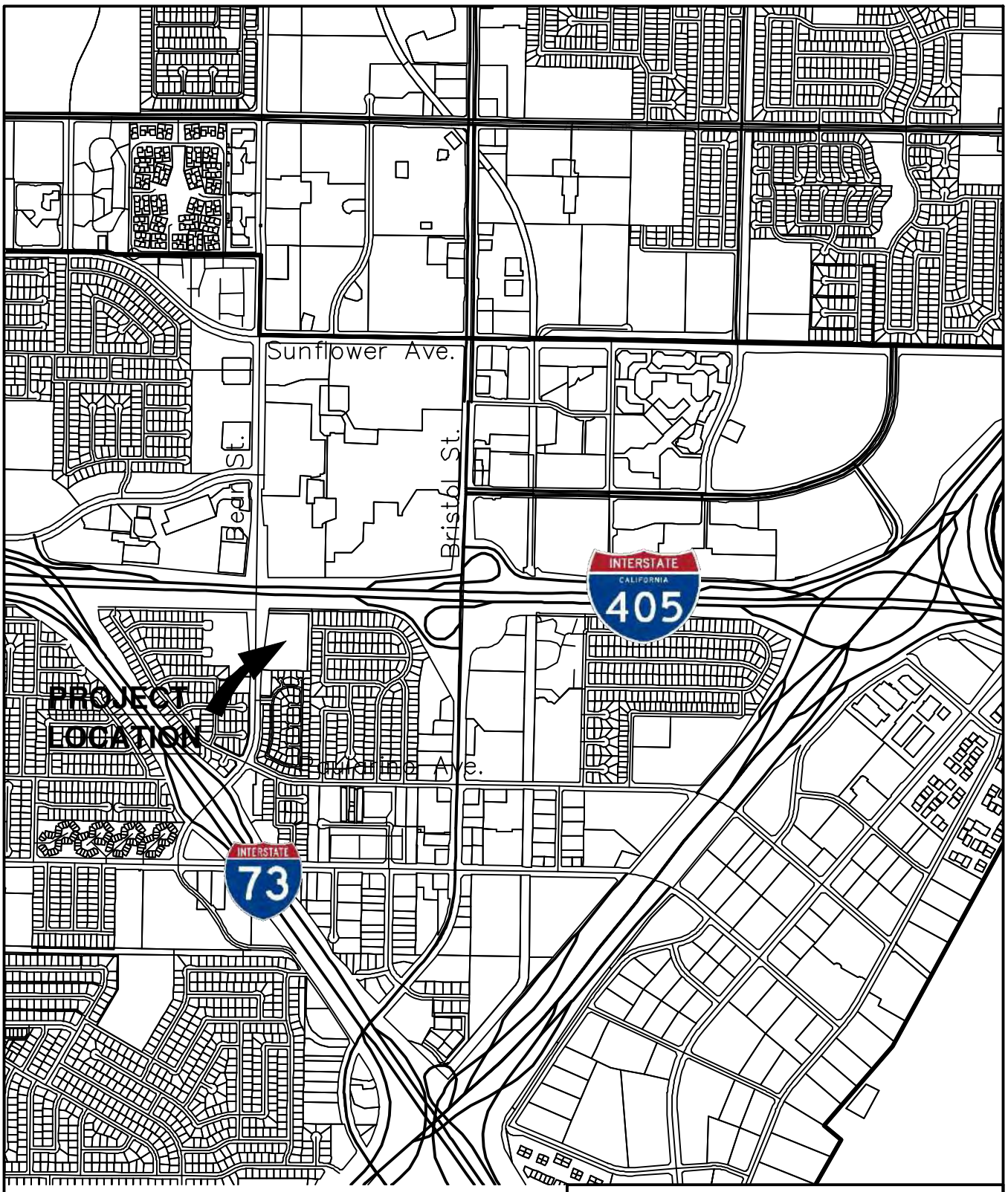
Standard Specifications for Public Works Construction, by Public Works Standards, Inc., 2015, *The Greenbook 2018 Edition*.

U.S. Geological Survey, 2013a, 2008 Interactive De-aggregations Program; web site address: http://geohazards.usgs.gov/deaggint/2008/.

U.S. Geological Survey, 2013b, U.S. Seismic Design Maps, web site address: http://earthquake.usgs.gov/hazards/designmaps/usdesign.php.

Youd, T. L. and Idriss, I. M., et al. (1997), *Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils,* National Center for Earthquake Engineering Research, Technical Report NCEER - 97-0022, January 5, 6, 1996.

Youd, T. L., Idriss, I. M., et al. (2001), *Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils*, ASCE Journal of Geotechnical and Geoenvironmental Engineering, Vol. 127, No. 10, October 2001.



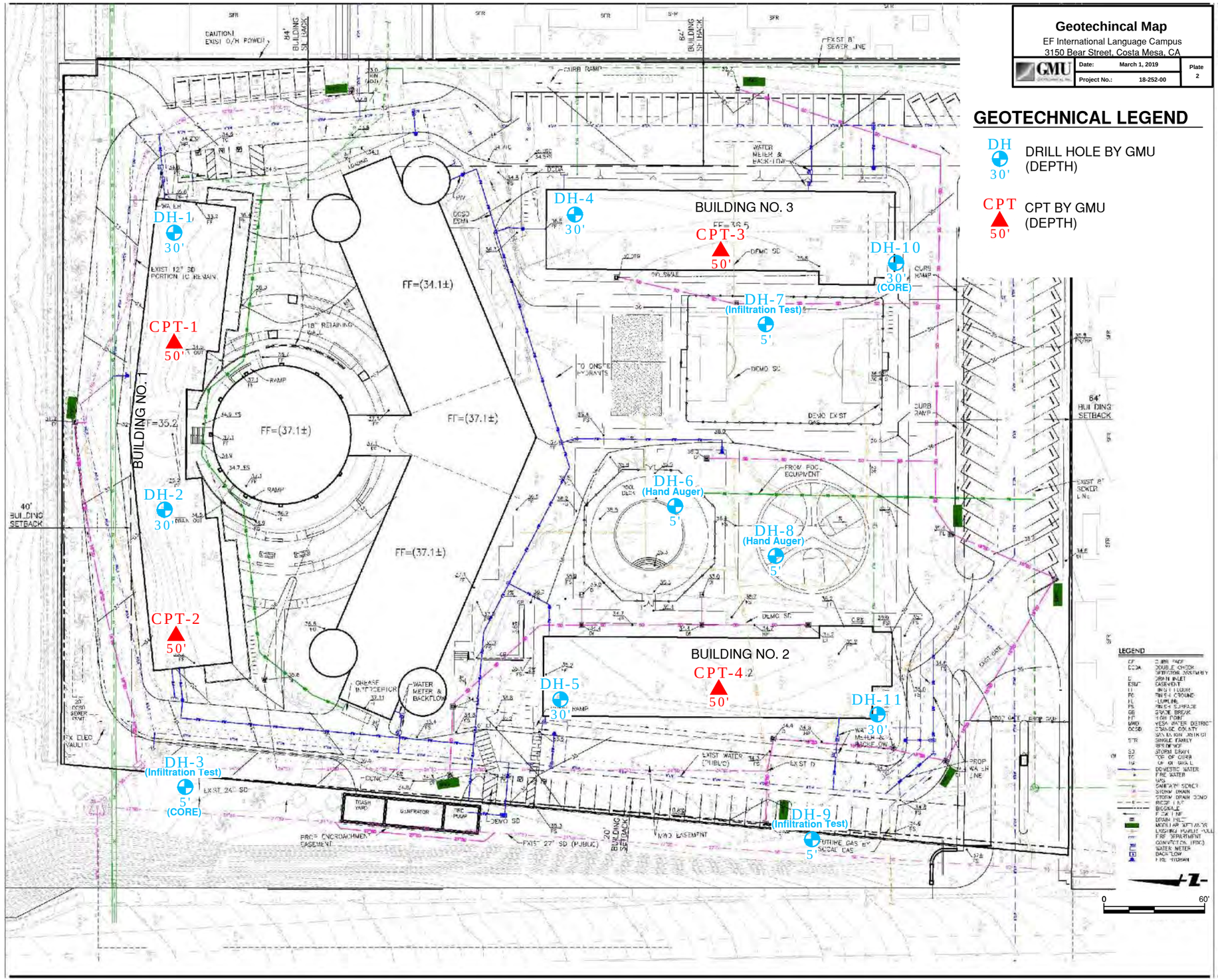
Location
3150 Bear Street
Costa Mesa, CA.

LOCATION MAP

GMU GEOTECHNICAL, INC.

Date:	March 1, 2019	Plate 1
Project No.:	18-252-00	

DRAWING: q:\2018\18-252-00\dwg\1825200_plate 1_site location map.dwg PLOTTED: 2/27/2019 11:37 AM BY: Nadim Sunna



Geotechincal Map

EF International Language Campus
3150 Bear Street, Costa Mesa, CA

GMU	Date:	March 1, 2019	Plate 2
	Project No.:	18-252-00	

GEOTECHNICAL LEGEND

DH 30' — DRILL HOLE BY GMU (DEPTH)

CPT 50' — CPT BY GMU (DEPTH)

EFEKTA GROUP, INC.
3150 Bear St.
Costa Mesa, CA 92626

Gensler

NOT FOR CONSTRUCTION

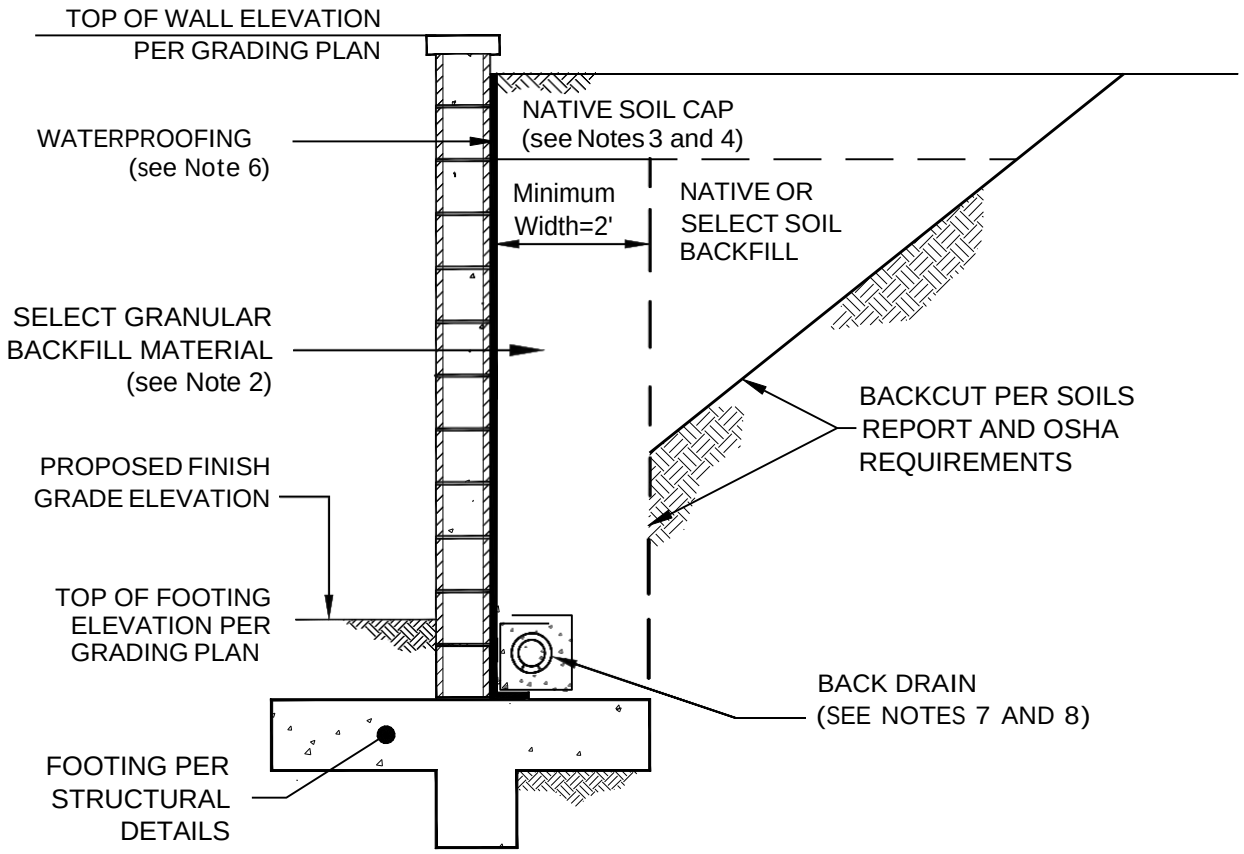
Project Name
EF INTERNATIONAL LANGUAGE CAMPUS COSTA MESA

Project Number
05.9948.500 | FUSCOE ENGINEERING 1793.001

Description
CONCEPTUAL GRADING PLAN

Scale

1



RETAINING WALL DETAIL

NOT TO SCALE

1. FINAL DETERMINATION OF THE MATERIAL TO BE USED FOR BACKFILL SHALL BE MADE BY GMU.

2. ALL SELECT BACKFILL TO WITHIN 1 TO 2 FEET OF FINAL GRADE SHOULD CONSIST OF FREE-DRAINING GRANULAR MATERIAL (I.E. SE 30 SAND, PEA GRAVEL, OR CRUSHED ROCK). CRUSHED ROCK, IF USED, SHOULD BE WRAPPED IN FILTER FABRIC (MIRAFI 140N OR EQUIVALENT) TO MINIMIZE THE POTENTIAL FOR MIGRATION OF FINES INTO THE ROCK. THE SELECT BACKFILL SHOULD BE MOISTURE CONDITIONED TO ACHIEVE OVER OPTIMUM MOISTURE CONTENT PER THE SOILS REPORT AND COMPACTED TO AT LEAST 90% RELATIVE COMPACTION AS DETERMINED BY ASTM TEST METHOD D 1557.

3. FINE-GRAINED NATIVE SOILS SHOULD BE USED TO CAP THE SELECT BACKFILL ZONE.

4. ALL NATIVE OR SELECT SOIL WALL BACKFILL SHOULD BE MOISTURE CONDITIONED AS NECESSARY TO OVER OPTIMUM MOISTURE CONTENT PER THE SOILS REPORT AND COMPACTED TO AT LEAST 90% RELATIVE COMPACTION AS DETERMINED BY ASTM TEST METHOD D 1557.

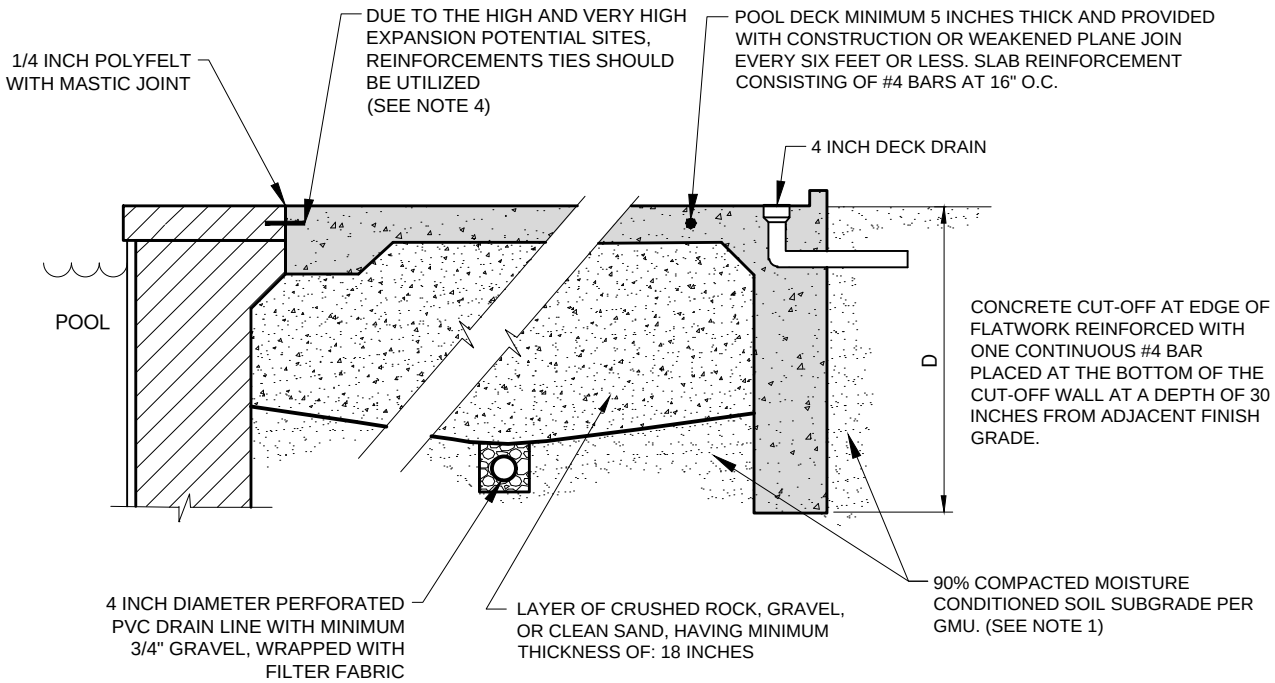
5. THE BACKSIDE OF THE WALLS SHOULD BE WATERPROOFED DOWN TO AND ACROSS THE TOP OF THE FOOTING. THE DESIGN AND SELECTION OF THE WATERPROOFING SYSTEM IS OUTSIDE OF THE PURVIEW OF GMU.

6. THE WATERPROOFING SYSTEM AND ANY DRAIN BOARDS SHOULD BE PROTECTED FROM DAMAGE BY CONSTRUCTION ACTIVITIES. THE TOP EDGE OF THE WATERPROOFING AND ANY DRAIN BOARDS SHOULD BE PROPERLY ADHERED TO THE WALL AND SEALED TO PREVENT THE POSSIBLE ACCUMULATION OF DEBRIS BETWEEN THE DRAINAGE/WATERPROOFING SYSTEM AND THE WALL.

7. THE BACKDRAIN SYSTEM SHOULD CONSIST OF 4" PERFORATED PIPE SURROUNDED BY AT LEAST ONE CUBIC FOOT OF 3/4"-1.5" OPEN GRADED GRAVEL WRAPPED IN MIRAFI 140N FILTER FABRIC (OR EQUIVALENT). THE PERFORATED PIPE SHOULD CONSIST OF SDR-35 OR SCHEDULE 40 PVC PIPE (OR APPROVED EQUIVALENT) LAID ON AT LEAST 2" OF CRUSHED ROCK WITH THE PERFORATIONS LAID DOWN. THE BACKDRAIN GRADIENT SHOULD NOT BE LESS THAN 1% WHEN POSSIBLE. THE PERFORATED PIPE SHOULD OUTLET INTO AREA DRAINS OR OTHER SUITABLE OUTLET POINTS AT RUNS OF 200 FEET OR LESS, IF PRACTICAL. IF THE BACKDRAINS CANNOT BE OUTLETED BY GRAVITY FLOW, A SUMP PUMP SYSTEM WILL NEED TO BE DESIGNED AND CONSTRUCTED. REDUNDANT BACK-UP PUMPS OR COMPONENTS ARE RECOMMENDED. DESIGN OF THIS SYSTEM IS OUTSIDE OF THE PURVIEW OF GMU.

8. THE TIE-IN LOCATIONS FOR BACKDRAIN OUTLETS SHOULD BE SHOWN ON THE PRECISE GRADING, SITE WALL, AND/OR LANDSCAPE PLANS.

GMU GEOTECHNICAL, INC.	**RETAINING WALL CONSTRUCTION DETAIL**	PLATE **3**



1. TO REDUCE THE POTENTIAL FOR EXCESSIVE CRACKING DUE TO EXPANSIVE SOIL FORCES, POOL DECK CONCRETE SLABS SHOULD BE A MINIMUM OF 5 INCHES THICK AND PROVIDED WITH CONSTRUCTION OR WEAKENED PLANE JOINTS AT FREQUENT INTERVALS (e.g., EVERY 6 FEET OR LESS). SLABS SHOULD BE UNDERLAIN BY A LAYER OF CRUSHED ROCK, GRAVEL, OR CLEAN SAND HAVING A MINIMUM THICKNESS OF 18 INCHES. PRESOAKING THE SUB GRADE TO A MINIMUM OF 4% OVER OPTIMUM AND TO A DEPTH OF 12 INCHES IS RECOMMENDED. PRESOAKING SHOULD BE OBSERVED, TESTED, AND ACCEPTED BY GMU PRIOR TO POURING THE CONCRETE.

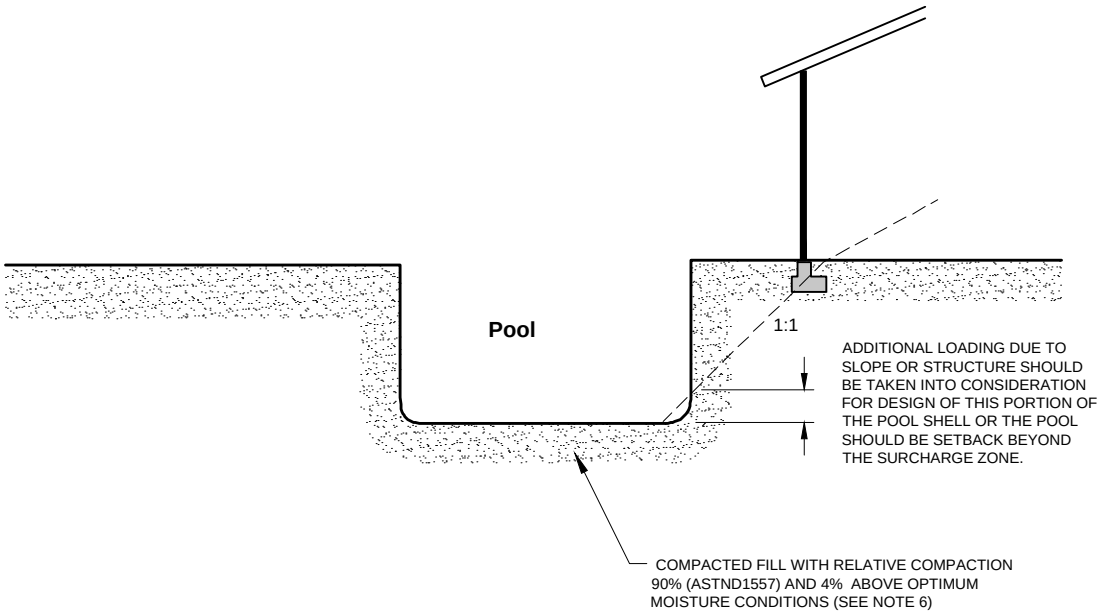
2. FOR POOL DECK ON SUBGRADES HAVING HIGH OR VERY HIGH EXPANSION POTENTIAL, A SUBDRAIN SYSTEM CONSISTING OF 4-INCH DIAMETER PERFORATED PIPE (PVC SCHEDULE 40, SDR 35, ARRMCO A2000 PVC, OR APPROVED EQUIVALENT), WRAPPED WITH FILTER FABRIC (MIRAFI 140N, 140NS, SUPAC 4NP, AMOCO 4545, TREVIRA 1114, OR APPROVED EQUIVALENT) SHOULD BE PROVIDED WITHIN THE SAND LAYER. ONE LINE OF SUBDRAIN AROUND THE SWIMMING POOL AREA IS CONSIDERED SUFFICIENT. THE PURPOSE OF THIS SUBDRAIN IS TO DRAIN POTENTIAL ACCUMULATED WATER WITHIN THE SAND LAYER AND OUTLET THE WATER INTO THE AREA DRAIN SYSTEM MINIMIZING THIS ACCUMULATION FROM SUBSTANTIALLY PERCOLATING DOWN INTO THE UNDERLYING SUBGRADE SOILS.

3. ALL CONCRETE HAS A TENDENCY TO CRACK AND CRACKS IN CONCRETE CAN BE CAUSED BY MANY DIFFERENT FACTORS. WHEN CONSTRUCTING CONCRETE DECKS, PATIOS, SIDEWALKS ETC., IT IS IMPORTANT THAT THE GROUND ON WHICH THESE IMPROVEMENTS ARE TO REST PROPERLY PREPARED, INCLUDING MOISTURE CONDITIONING. SLAB THICKNESS, LOCATION OF JOINTS, REINFORCEMENT, AND CONCRETE MIXTURE MUST ALSO BE APPROPRIATE FOR THE INTENDED USE. PROPER PLACEMENT, FINISHING, AND CURING OF CONCRETE ARE ALSO VERY IMPORTANT FACTORS IN MINIMIZING CRACKING.

4. DUE TO THE HIGH TO VERY HIGH EXPANSION POTENTIAL, IT IS RECOMMENDED THAT THE DECK BE STRUCTURALLY TIED TO THE POOL WALL. THE POOL DESIGNER SHOULD EVALUATE THE EFFECTS OF THIS CONNECTION ON THE POOL SHELL (IF ANY) AND PROVIDE FINAL DESIGN FOR THE REINFORCEMENT. IF THE POOL DESIGNER ELECT NOT TO STRUCTURALLY TIE THE DECK TO THE POOL, UPLIFT OF THE DECK RELATIVE TO THE POOL SHOULD BE EXPECTED.

5. THE SITE HAS SEVERE LEVELS OF SULFATES. CONSEQUENTLY, THE CEMENT TYPE SHOULD BE Type V. CONCRETE MIX DESIGN SHALL BE SELECTED BY THE CONCRETE DESIGNER SUCH THAT SULFATE ATTACK MITIGATION IS BALANCED WITH SHRINKAGE CRACK CONTROL. CONCRETE MIX DESIGN IS OUTSIDE THE GEOTECHNICAL ENGINEER'S PURVIEW.

GMU GEOTECHNICAL, INC.	**POOL DECK DETAIL FOR EXPANSIVE SOIL SITES**	Plate **4**



1. THE POOL WALLS SHOULD BE DESIGNED TO ACCOUNT FOR A HIGH TO VERY HIGH EXPANSION - EFP = 125psf/ft THE ACTUAL EXPANSIVENESS OF SOILS EXPOSED IN POOL EXCAVATION SHOULD BE EVALUATED UPON COMPLETION OF THE EXCAVATION AS POOL SUBGRADE SOILS ARE EXPOSED.

2. WHERE POOLS ARE PLANNED NEAR STRUCTURES, APPROPRIATE SURCHARGE LOADS SHOULD BE INCORPORATED INTO THE DESIGN AND CONSTRUCTION.

3. IN ORDER TO PROVIDE UNIFORM CONDITIONS, THE BOTTOM OF THE POOL EXCAVATION MAY NEED TO BE OVER-EXCAVATED AND REPLACED TO POOL SUBGRADE WITH COMPACTED FILL.

4. WHEREAS POOL EXCAVATION MAY BE FREE OF WATER AT A TIME OF CONSTRUCTION, FUTURE IRRIGATION COULD RESULT IN THE DEVELOPMENT OF PERCHED WATER ZONES WHICH COULD AFFECT SUBSURFACE IMPROVEMENTS. HEAVY-DUTY PIPES AND FLEXIBLE COUPLINGS SHOULD BE USED FOR THE POOL PLUMBING SYSTEM TO MINIMIZE LEAKING WHICH MAY PRODUCE ADDITIONAL PRESSURES ON THE POOL SHELL. IN ADDITION, INSTALLATION OF A PRESSURE VALVE IN THE POOL BOTTOM SHOULD BE USED TO MITIGATE POTENTIAL BUILD-UP OF PRESSURE.

5. IN GENERAL, ALL BELOW GRADE IMPROVEMENTS MUST BE CONSTRUCTED BY QUALIFIED PROFESSIONALS UTILIZING APPROPRIATE DESIGNS WHICH ACCOUNT FOR THE ON-SITE GEOTECHNICAL AND GEOLOGIC CONDITIONS. OBSERVATION/TESTING SHOULD BE PERFORMED BY GMU DURING POOL EXCAVATION TO VERIFY EXPOSED SOIL CONDITIONS ARE CONSISTENT WITH THE ASSUMED DESIGN CONDITIONS.

6. THE DESIGN SHOULD CONSIDER THAT THE ONSITE SOILS ARE SEVERELY CORROSIVE TO FERROUS METALS. IN ADDITION, DUE TO THE SEVERE SULFATE EXPOSURE (SULFATE EXPOSURE CATEGORY "S2"), THE TYPE OF PORTLAND CEMENT, WATER TO CEMENT RATIO, AND THE CONCRETE COMPRESSIVE STRENGTH SHOULD BE IN ACCORDANCE WITH ACI 318-14, TABLE 19.3.2.1. FINAL CONCRETE MIX DESIGN IS OUTSIDE OUR PURVIEW.

7. IT SHOULD BE NOTED THAT IMPLEMENTATION OF THE ABOVE RECOMMENDATIONS ONLY SERVE TO REDUCE THE POTENTIAL FOR EXPANSIVE SOIL RELATED MOVEMENTS INCLUDING SLOPE CREEP AND LATERAL FILL EXTENSION. THE RECOMMENDATIONS ARE NOT INTENDED TO ELIMINATE THESE TYPES OF MOVEMENTS. CONSEQUENTLY, SOME DISTORTION SHOULD BE ANTICIPATED.

APPENDIX A

Geotechnical Exploration Procedures, Drill Hole Logs, and Cone Penetration Testing Data by GMU Geotechnical, Inc.

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APPENDIX A

GMU GEOTECHNICAL EXPLORATION PROCEDURES, DRILL HOLE LOGS, AND CONE PENETRATION TESTING DATA

Our exploration at the subject site consisted of eleven (11) drilled holes to a maximum depth of 31.5 feet below the existing grade and four (4) Cone Penetration Testing (CPT) soundings to a maximum depth of 50 feet below the existing grade. Our drilled holes were logged by a Staff Engineer, and drive, bulk, and Standard Penetration Test (SPT) samples of the excavated soils were collected. Blow counts recorded during sampling from the California Modified Sampler (Cal Mod) and SPT are shown on the drill hole logs. The logs of each drill hole are contained in this Appendix A, and the Legend to Logs is presented as Plates A-1 and A-2. The CPT data are presented in Appendix A-1. The approximate locations of the drill holes and CPT's are shown on Plate 2 – Geotechnical Map.

"Undisturbed" Cal Mod samples were taken using a 3.0-inch, thin walled, outside-diameter drive sampler which contains a 2.416-inch-diameter brass sample sleeve that is 6 inches in length. SPT samples were obtained using a 2.0-inch outside diameter split spoon sampler without liners. Bulk samples of the soil materials were also collected from the upper 5 feet of the site soils.

The geologic and engineering field descriptions and classifications that appear on these logs are prepared according to Corps of Engineers and Bureau of Reclamation standards. Major soil classifications are prepared according to the Unified Soil Classification System as modified by ASTM Standard No. 2487. Since the descriptions and classifications that appear on the Log of Drill Hole are intended to be that which most accurately describe a given interval of a drill hole (frequently an interval of several feet), discrepancies do occur in the Unified Soil Classification System nomenclature between that interval and a particular sample in that interval. For example, an 8-foot-thick interval in a log may be identified as silty sand (SM) while one sample taken within the interval may have individually been identified as sandy silt (ML). This discrepancy is frequently allowed to remain to emphasize the occurrence of local textural variations in the interval.

MAJOR DIVISIONS			Group Letter	Symbol	TYPICAL NAMES
COARSE-GRAINED SOILS More Than 50% Retained On No.200 Sieve Based on The Material Passing The 3-Inch (75mm) Sieve. Reference: ASTM Standard D2487	**GRAVELS** 50% or More of Coarse Fraction Retained on No.4 Sieve	Clean Gravels	**GW**		Well Graded Gravels and Gravel-Sand Mixtures, Little or No Fines.
			GP		Poorly Graded Gravels and Gravel-Sand Mixtures Little or No Fines.
		Gravels With Fines	**GM**		Silty Gravels, Gravel-Sand-Silt Mixtures.
			GC		Clayey Gravels, Gravel-Sand-Clay Mixtures.
	SANDS More Than 50% of Coarse Fraction Passes No.4 Sieve	Clean Sands	**SW**		Well Graded Sands and Gravelly Sands, Little or No Fines.
			SP		Poorly Graded Sands and Gravelly Sands, Little or No Fines.
		Sands With Fines	**SM**		Silty Sands, Sand-Silt Mixtures.
			SC		Clayey Sands, Sand-Clay Mixtures.
FINE-GRAINED SOILS 50% or More Passe The No.200 Sieve Based on The Material Passing The 3-Inch (75mm) Sieve. Reference: ASTM Standard D2487	**SILTS AND CLAYS** Liquid Limit Less Than 50%		**ML**		Inorganic Silts, Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts With Slight Plasticity.
			CL		Inorganic Clays of Low To Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays.
			OL		Organic Silts and Organic Silty Clays of Low Plasticity
	SILTS AND CLAYS Liquid Limit 50% or Greater		**MH**		Inorganic Silts, Micaceous or Diatomaceous Fine Sandy or Silty Soils, Elastic Silts.
			CH		Inorganic Clays of High Plasticity, Fat Clays.
			OH		Organic Clays of Medium To High Plasticity, Organic Silts.
HIGHLY ORGANIC SOILS			**PT**		Peat and Other Highly Organic Soils.

The descriptive terminology of the logs is modified from current ASTM Standards to suit the purposes of this study

ADDITIONAL TESTS

DS = Direct Shear
HY = Hydrometer Test
TC = Triaxial Compression Test
UC = Unconfined Compression
CN = Consolidation Test
(T) = Time Rate
EX = Expansion Test
CP = Compaction Test
PS = Particle Size Distribution
EI = Expansion Index
SE = Sand Equivalent Test
AL = Atterberg Limits
FC = Chemical Tests
RV = Resistance Value
SG = Specific Gravity
SU = Sulfates
CH = Chlorides
MR = Minimum Resistivity
pH
(N) = Natural Undisturbed Sample
(R) = Remolded Sample
CS = Collapse Test/Swell-Settlement

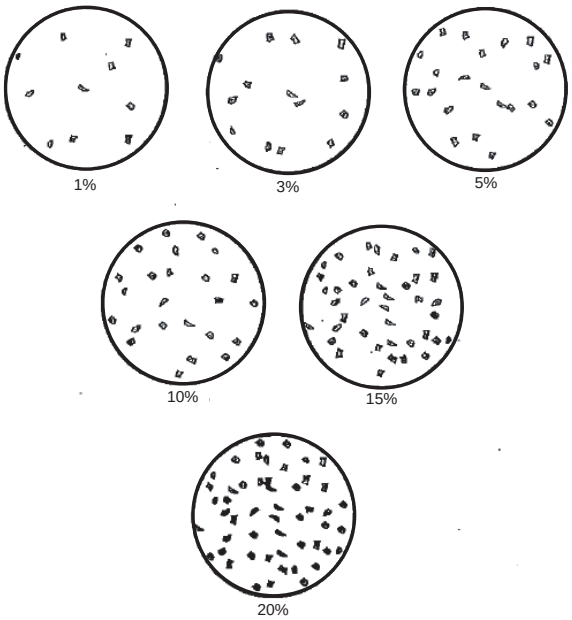
GEOLOGIC NOMENCLATURE

B = Bedding C = Contact J = Joint
F = Fracture Flt = Fault S = Shear
RS = Rupture Surface = Seepage
= Groundwater

SAMPLE SYMBOLS

Undisturbed Sample (California Sample)
Undisturbed Sample (Shelby Tube)
Bulk Sample
Unsuccessful Sampling Attempt
SPT Sample

10: 10 Blows for 12-Inches Penetration
6/4: 6 Blows Per 4-Inches Penetration
P: Push
(13): Uncorrected Blow Counts ("N" Values) for 12-Inches Penetration- Standard Penetration Test (SPT)



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LEGEND TO LOGS
ASTM Designation: D 2487
(Based on Unified Soil Classification System)

Plate
A-1

P8-11/16/2012

SOIL DENSITY/CONSISTENCY

FINE GRAINED

Consistency	Field Test	SPT (#blows/foot)	Mod (#blows/foot)
Very Soft	Easily penetrated by thumb, exudes between fingers	<2	<3
Soft	Easily penetrated one inch by thumb, molded by fingers	2-4	3-6
Firm	Penetrated over 1/2 inch by thumb with moderate effort	4-8	6-12
Stiff	Penetrated about 1/2 inch by thumb with great effort	8-15	12-25
Very Stiff	Readily indented by thumbnail	15-30	25-50
Hard	Indented with difficulty by thumbnail	>30	>50

COARSE GRAINED

Density	Field Test	SPT (#blows/foot)	Mod (#blows/foot)
Very Loose	Easily penetrated with 0.5" rod pushed by hand	<4	<5
Loose	Easily penetrated with 0.5" rod pushed by hand	4-10	5-12
Medium Dense	Easily penetrated 1' with 0.5" rod driven by 5lb hammer	10-30	12-35
Dense	Dificult to penetrat 1' with 0.5" rod driven by 5lb hammer	31-50	35-60
Very Dense	Penetrated few inches with 0.5" rod driven by 5lb hammer	>50	>60

BEDROCK HARDNESS

Density	Field Test	SPT (#blows/foot)
Soft	Can be crushed by hand, soil like and structureless	1-30
Moderately Hard	Can be grooved with fingernails, crumbles with hammer	30-50
Hard	Can't break by hand, can be grooved with knife	50-100
Very Hard	Scratches with knife, chips with hammer blows	>100

MODIFIERS

Trace	1%
Few	1-5%
Some	5-12%
Numerous	12-20%
Abundant	>20%

GRAIN SIZE

Description		Sieve Size	Grain Size	Approximate Size
Boulders		>12"	>12"	Larger than a basketball
Cobbles		3-12"	3-12"	Fist-sized to basketball-sized
Gravel	Coarse	3/4-3"	3/4-3"	Thumb-sized to fist-sized
	Fine	#4-3/4"	0.19-0.75"	Pea-sized to thumb-sized
Sand	Coarse	#10-#4	0.079-0.19"	Rock-salt-sized to pea-sized
	Medium	#40-#10	0.017-0.079"	Sugar-sized to rock salt-sized
	Fine	#200-#40	0.0029-0.017"	Flour-sized to sugar-sized
Fines		passing #200	<0.0029"	Flour-sized and smaller

MOISTURE CONTENT

Dry- Very little or no moisture
Damp- Some moisture but less than optimum
Moist- Near optimum
Very Moist- Above optimum
Wet/Saturated- Contains free moisture

GMU GEOTECHNICAL, INC.

LEGEND TO LOGS

Plate

A-2

Project: EF International Language Campus **Project Location: 3150 Bear Street, Costa Mesa** **Project Number: 18-252-00**	**Log of Drill Hole DH- 1** Sheet 1 of 2

Date(s) Drilled	**1/2/19**	Logged By	**AAV**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**30.9 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**34.7**
Groundwater Depth [Elevation], feet	**20.5 [14.2]**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Bentonite Chips and Native**
Remarks				Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL some rootlets		SILTY CLAY (CL); olive brown with white and olive mottling, moist, firm to stiff, some fine to medium grained sand, some fine gravel						
			YOUNG AXIAL CHANNEL DEPOSITS (Qya)		FAT CLAY (CH); olive brown with white and olive mottling, moist, firm to stiff, some fine to medium grained sand, some fine gravel		4 8 8	140	21	101	
30	5		some caliche		stiff		4 5 8	140	38	82	
			increase in caliche				7 11 13	140	30	89	
25	10				becomes olive with orange root stains, trace fine to medium grained sand		8 8 10	140	28	94	
					SILTY CLAY (CL); yellowish brown, moist, stiff		5 5 10	140	16	113	
					POORLY GRADED SAND WITH SILT (SP-SM); yellowish brown with orange staining, moist, medium dense, sand is very fine to fine grained						
20	15				sand becomes fien to medium grained with some coarse grained sand, some fine gravel with trace coarse gravel		8 10 13	140	4		
			some caliche		SILTY CLAY (CL); olive brown, very moist to wet, stiff, trace gravel						
15											

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GMU GEOTECHNICAL, INC.

Drill Hole DH- 1

Project: EF International Language Campus
Project Location: 3150 Bear Street, Costa Mesa
Project Number: 18-252-00

Log of Drill Hole DH- 1

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			some caliche			▽	11 16 22	140	20	107	
10	25						6 19 25	140			
					SILTY SAND (SM); yellowish brown, wet, medium dense to dense, sand is fine to medium grained with coarse grained, some fine gravel						
5	30				POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); yellowish brown, wet, very dense, sand is medium to coarse grained, gravel is fine to coarse		26 50/5"	140	8	136	
					Total Depth = 30.92 ft Groundwater encountered at 20.5 ft below ground surface						

GMU GEOTECHNICAL, INC.

Drill Hole DH- 1

Project: EF International Language Campus **Project Location: 3150 Bear Street, Costa Mesa** **Project Number: 18-252-00**	**Log of Drill Hole DH- 2** Sheet 1 of 2

Date(s) Drilled	**1/2/19**	Logged By	**AAV**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**31.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**35.3**
Groundwater Depth [Elevation], feet	**18.3 [16.9]**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Bentonite Chips and Native**
Remarks				Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
35			**TOPSOIL** some rootlets		LEAN CLAY (CL); brown to dark brown with some orange mottling, moist to very moist, stiff						
			YOUNG AXIAL CHANNEL DEPOSITS (Qya) some rootlets, some caliche		FAT CLAY (CH); brown to dark brown with some orange mottling, moist to very moist, stiff		5 7 12	140	23	99	
30	5				brown, moist, stiff, some fine grained sand		5 6 9	140	28	92	
					becomes brown with orange and black mottling		8 11 14	140	15	117	
25	10				becomes light brown with some very fine grained sand pockets		6 7 12	140	21	106	
					SANDY SILT (ML); light brown with orange staining, damp to moist, stiff, sand is very fine grained, few fine gravel		8 11 13	140	17	115	
			some caliche		CLAYEY SILT (ML); light brown, moist, stiff, some very fine grained sand pockets						
20	15				SANDY CLAY (CL); light brown with orange mottling and white veins, moist, stiff		9 10 12	140	26	100	

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GMU GEOTECHNICAL, INC.

Drill Hole DH- 2

Project: EF International Language Campus
Project Location: 3150 Bear Street, Costa Mesa
Project Number: 18-252-00

Log of Drill Hole DH- 2

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
15					no white veins, becomes very moist, some fine grained sand		3 4 7	140			
10	25				SILTY SAND (SM); light yellowish brown, wet, dense, sand is very fine to fine grained with trace coarse sand		13 16 29	140	17	114	
5	30				POORLY GRADED SAND (SP) with GRAVEL; light brown, wet, medium dense to dense, sand is fine to medium grained with some coarse grained sand, some fine to coarse gravel		12 14 19	140			
					Total Depth = 31.5 ft Groundwater encountered at 18.33 ft below ground surface						

GMU GEOTECHNICAL, INC.

Drill Hole DH- 2

Project: EF International Language Campus **Project Location: 3150 Bear Street, Costa Mesa** **Project Number: 18-252-00**	**Log of Drill Hole DH- 3** Sheet 1 of 1

Date(s) Drilled	**1/2/19**	Logged By	**AAV**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**5.0 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**34.7**
Groundwater Depth [Elevation], feet	**N/A []**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Native**
Remarks	**Infiltration test location**			Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL some rootlets, some caliche		SILTY CLAY (CL); dark brown with some orange mottling, moist, stiff, trace fine to medium grained sand						
			YOUNG AXIAL CHANNEL DEPOSITS (Qya)		SILTY CLAY (CL); dark brown with some orange mottling, moist, stiff, trace fine to medium grained sand		6 6 13	140	19	108	
30	5				Total Depth = 5 ft No groundwater encountered Performed infiltration testing at this location						

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GMU GEOTECHNICAL, INC.

Drill Hole DH- 3

Project: EF International Language Campus **Project Location: 3150 Bear Street, Costa Mesa** **Project Number: 18-252-00**	**Log of Drill Hole DH- 4** Sheet 1 of 2

Date(s) Drilled	**1/4/19**	Logged By	**MTF**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**31.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**34.7**
Groundwater Depth [Elevation], feet	**20.0 [14.7]**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Bentonite Chips and Native**
Remarks				Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL some rootlets		SILTY CLAY (CL); brown, very moist, firm to stiff, with trace fine to medium grained sand						
			YOUNG AXIAL CHANNEL DEPOSITS		FAT CLAY (CH); brown, very moist, firm to stiff, with trace fine to medium grained sand						
					brown, gray, and dark gray, very moist, stiff		4 6 9	140	24	99	
30	5						7 8 13	140	28	86	
			some caliche		becomes light gray		7 9 11	140	32	84	
25	10		numerous caliche		SILTY CLAY (CL); light brown, very moist, stiff		8 10 11	140	17	113	
					LEAN CLAY (CL); light gray and white, very moist, very stiff		8 10 18	140	17	108	
20	15		numerous concretions		SITLY CLAY (CL); light brown, very moist, stiff		4 6 8	140			
15											

GMU GEOTECHNICAL, INC.

Drill Hole DH- 4

Project: EF International Language Campus
Project Location: 3150 Bear Street, Costa Mesa
Project Number: 18-252-00

Log of Drill Hole DH- 4

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
							11 14 17	140	16	112	
10	25				CLAYEY SAND (SC); brown and light brown, very moist to saturated, dense, sand is fine to medium grained		6 12 22	140			
					POORLY GRADED SAND (SP); light brown, saturated, dense to very dense, sand is medium grained						
5	30						8 22 38	140	16	118	
					Total Depth = 31.0 ft Groundwater Encountered at 20.0 ft below ground surface						

GMU GEOTECHNICAL, INC.

Drill Hole DH- 4

Project: EF International Language Campus **Project Location: 3150 Bear Street, Costa Mesa** **Project Number: 18-252-00**	**Log of Drill Hole DH- 5** Sheet 1 of 2

Date(s) Drilled	**1/4/19**	Logged By	**MTF**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**31.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**34.7**
Groundwater Depth [Elevation], feet	**20.7 [14.0]**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Bentonite Chips and Native**
Remarks				Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL some rootlets		SILTY CLAY (CL); brown, very moist, firm to stiff, with some fine to medium grained sand						
			YOUNG AXIAL CHANNEL DEPOSITS		SILTY CLAY (CL); brown, very moist, firm to stiff, with some fine to medium grained sand						
					CLAYEY SAND (SC); orangeish brown, moist to very moist, medium dense, fine to medium grained sand with trace coarse grained sand		9 10 13	140	10	105	
30	5				SILTY CLAY (CL); light brown, damp to moist, very stiff, with some fine grained sand		15 15 29	140	6	120	
							10 14 24	140	11	124	
25	10				CLAYEY SAND (SC); light brown, moist to very moist, medium dense, medium grained sand		12 11 13	140	8	114	
					SILTY SAND (SM); light gray, very moist, very stiff, with some fine grained sand		9 12 16	140	5	107	
20	15		numerous caliche		SILTY CLAY (CL); light gray, very moist to saturated, stiff		5 7 12	140	20	104	
15											

GMU GEOTECHNICAL, INC.

Drill Hole DH- 5

Project: EF International Language Campus
Project Location: 3150 Bear Street, Costa Mesa
Project Number: 18-252-00

Log of Drill Hole DH- 5

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
							7 10 13	140	26	95	
10	25				becomes saturated		8 10 10	140			
					POORLY GRADED SAND WITH SILT (SP-SM); white, gray, and black, saturated, medium dense, medium grained sand						
5	30						4 7 13	140			
					Total Depth = 31.5 ft Groundwater encountered at 20.7 ft below ground surface						

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GMU GEOTECHNICAL, INC.

Project: EF International Language Campus **Project Location: 3150 Bear Street, Costa Mesa** **Project Number: 18-252-00**	**Log of Drill Hole DH- 6** Sheet 1 of 1

Date(s) Drilled	**1/2/19**	Logged By	**MTF**	Checked By	**NS**
Drilling Method	**Hand Auger**	Drilling Contractor	**Earthworks Techniques, Inc.**	Total Depth of Drill Hole	**5.8 feet**
Drill Rig Type	**N/A**	Diameter(s) of Hole, inches	**3**	Approx. Surface Elevation, ft MSL	**36.0**
Groundwater Depth [Elevation], feet	**N/A []**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Native**
Remarks				Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL		CLAYEY SAND (SC); brown, moist, medium dense, sand is fine to medium grained						
35			**YOUNG AXIAL CHANNEL DEPOSITS (Qya)**		SANDY CLAY (CL); brown, moist, stiff, sand is fine to medium grained becomes orangish brown, moist to wet				15	107	
					becomes very moist, sand is fine to coarse grained						
	5				FAT CLAY (CH); dark grayish brown, very moist, stiff to very stiff				30	77	
					Total Depth = 5.83 ft No groundwater encountered						

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

Drill Hole DH- 6

Project: EF International Language Campus **Project Location: 3150 Bear Street, Costa Mesa** **Project Number: 18-252-00**	**Log of Drill Hole DH- 7** Sheet 1 of 1

Date(s) Drilled	**1/2/19**	Logged By	**AAV**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**5.0 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**33.5**
Groundwater Depth [Elevation], feet	**N/A []**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Native**
Remarks	**Infiltration test location**			Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL some rootlets		SILTY CLAY (CL); brown to dark gray with white and orange mottling, moist, stiff						
			YOUNG AXIAL CHANNEL DEPOSITS (Qya)		FAT CLAY (CH); brown to dark gray with white and orange mottling, moist, stiff						
30							4 7 11	140	39	82	
	5				Total Depth = 5 ft No groundwater encountered Performed infiltration testing at this location						

GMU GEOTECHNICAL, INC.

Drill Hole DH- 7

Project: EF International Language Campus **Project Location: 3150 Bear Street, Costa Mesa** **Project Number: 18-252-00**	**Log of Drill Hole DH- 8** Sheet 1 of 1

Date(s) Drilled	**1/2/19**	Logged By	**MTF**	Checked By	**NS**
Drilling Method	**Hand Auger**	Drilling Contractor	**Earthworks Techniques, Inc.**	Total Depth of Drill Hole	**5.7 feet**
Drill Rig Type	**N/A**	Diameter(s) of Hole, inches	**3**	Approx. Surface Elevation, ft MSL	**35.4**
Groundwater Depth [Elevation], feet	**N/A []**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Native**
Remarks				Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
35			**TOPSOIL**		CLAYEY SAND (SC); brown, damp to moist, medium dense, sand is fine to medium grained						
			YOUNG AXIAL CHANNEL DEPOSITS (Qya) some rootlets		SANDY CLAY (CL); brown to light brown, very moist, sand is fine grained, highly plastic						
									23	94	
					becomes light yellowish brown, with siltstone fragments						
					FAT CLAY (CH); dark grayish black, moist, stiff to very stiff						
	5										
30									15	90	
					Total Depth = 5.67 ft No groundwater encountered						

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GMU GEOTECHNICAL, INC.

Drill Hole DH- 8

Project: EF International Language Campus **Project Location: 3150 Bear Street, Costa Mesa** **Project Number: 18-252-00**	**Log of Drill Hole DH- 9** Sheet 1 of 1

Date(s) Drilled	**1/2/19**	Logged By	**AAV**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**5.0 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**34.0**
Groundwater Depth [Elevation], feet	**N/A []**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Native**
Remarks	**Infiltration test location**			Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL some rootlets, some caliche		SILTY CLAY (CL); dark brown with some orange mottling, moist, stiff, trace fine to medium grained sand						
			YOUNG AXIAL CHANNEL DEPOSITS (Qya)		SILTY CLAY (CL); dark brown with some orange mottling, moist, stiff, trace fine to medium grained sand						
30											
	5				Total Depth = 5 ft No groundwater encountered Performed infiltration testing at this location						

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GMU GEOTECHNICAL, INC.

Drill Hole DH- 9

Project: EF International Language Campus **Project Location: 3150 Bear Street, Costa Mesa** **Project Number: 18-252-00**	**Log of Drill Hole DH-10** Sheet 1 of 2

Date(s) Drilled	**1/2/19**	Logged By	**AAV**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**31.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**34.6**
Groundwater Depth [Elevation], feet	**18.5 [16.1]**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Bentonite Chips and Native**
Remarks				Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			PORTLAND CEMENT CONCRETE (PCC)		PORTLAND CEMENT CONCRETE (PCC) = 6-inches						
			AGGREGATE BASE (AB)		AGGREGATE BASE (AB); 3/4-inch crushed aggregate, dry to damp, very dense, subangular to angular, significant fines						
			YOUNG AXIAL CHANNEL DEPOSITS (Qya)		SILTY CLAY (CL); brown to dark brown, damp to moist, stiff, some fine to coarse grained sand, some fine to coarse gravel becomes dark gray		14 8 10	140	11	98	
					becomes brown						
30	5						7 7 17	140	21	104	
					becomes light gray, dry to damp, no sand or gravel						
					becomes gray with orange staining, some fine to medium grained sand		10 10 13	140	10	122	
25	10				becomes brown with orange staining, few fine gravel		10 13 20	140	10	124	
					CLAYEY SAND (SC); orangish brown, damp, dense, sand is fine to medium grained with coarse grained sand, some fine to coarse gravel		12 15 21	140	4	119	
20	15				SANDY CLAY (CL) with GRAVEL; yellowish brown, moist, dense to very dense, sand is fine to coarse grained, gravel is fine to coarse		13 22 29	140	11	122	
15											

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GMU GEOTECHNICAL, INC.

Drill Hole DH-10

Project: EF International Language Campus
Project Location: 3150 Bear Street, Costa Mesa
Project Number: 18-252-00

Log of Drill Hole DH-10

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
					CLAYEY SAND (SC); yellowish brown, wet, dense, sand is fine to coarse grained, some fine gravel		14 23 23	140			
10	25				GRAVELLY SAND (SG) with CLAY; yellowish brown, wet, very dense, sand is medium to coarse grained, gravel is fine to coarse		32 50/5"	140	11	130	
5	30				POORLY GRADED SAND (SP) with SILT; grayish brown, wet, medium dense, sand is very fine to fine grained		7 12 10	140			
					Total Depth = 31.5 ft Groundwater encountered at 18.5 ft below ground surface						

GMU GEOTECHNICAL, INC.

Project: EF International Language Campus **Project Location: 3150 Bear Street, Costa Mesa** **Project Number: 18-252-00**	**Log of Drill Hole DH-11** Sheet 1 of 2

Date(s) Drilled	**1/2/19**	Logged By	**AAV**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**31.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**33.7**
Groundwater Depth [Elevation], feet	**18.9 [14.8]**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Bentonite Chips and Native**
Remarks				Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL some rootlets		SILTY CLAY (CL); dark brown, damp, firm to stiff, some fine to medium grained sand						
			YOUNG AXIAL CHANNEL DEPOSITS (Qya)		SILTY CLAY (CL); dark brown, damp, firm to stiff, some fine to medium grained sand		4 5 7	140	14	118	
30					SANDY CLAY (CL); reddish brown, damp, firm, sand is very fine to fine grained						
	5				SILTY CLAY (CL); reddish brown, moist, firm, some very fine to fine grained sand		3 5 6	140			
25					SANDY CLAY (CL); yellowish brown, moist to very moist, stiff, sand is very fine to fine grained		6 12 12	140	14	114	
	10						6 9 11	140			
20					CLAYEY SAND (SM); light yellowish brown, damp, medium dense, sand is very fine to fine grained		9 12 15	140	8	110	
	15				CLAYEY SILT (ML); light olive brown, moist to very moist, firm		4 5 7	140			
15					SILTY SAND (SM); light yellowish brown, wet, medium dense, sand is very fine to fine grained ∇						

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GMU GEOTECHNICAL, INC.

Drill Hole DH-11

Project: EF International Language Campus
Project Location: 3150 Bear Street, Costa Mesa
Project Number: 18-252-00

Log of Drill Hole DH-11

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
							7 9 14	140	21	110	
					SILTY CLAY (CL); ligth yellowish brown with orange staining, wet, stiff, trace fine gravel						
10											
	25				becomes very moist		5 12 15	140			
5											
					POORLY GRADED SAND (SP); light yellowish brown, wet, dense, sand is fine grained with medium grained sand						
	30						7 14 26	140	22	102	
					Total Depth = 31.5 ft Groundwater encountered at 18.92 ft below ground surface						

GMU GEOTECHNICAL, INC.

Drill Hole DH-11

APPENDIX A-1

Cone Penetration Testing Data by GMU Geotechnical, Inc.

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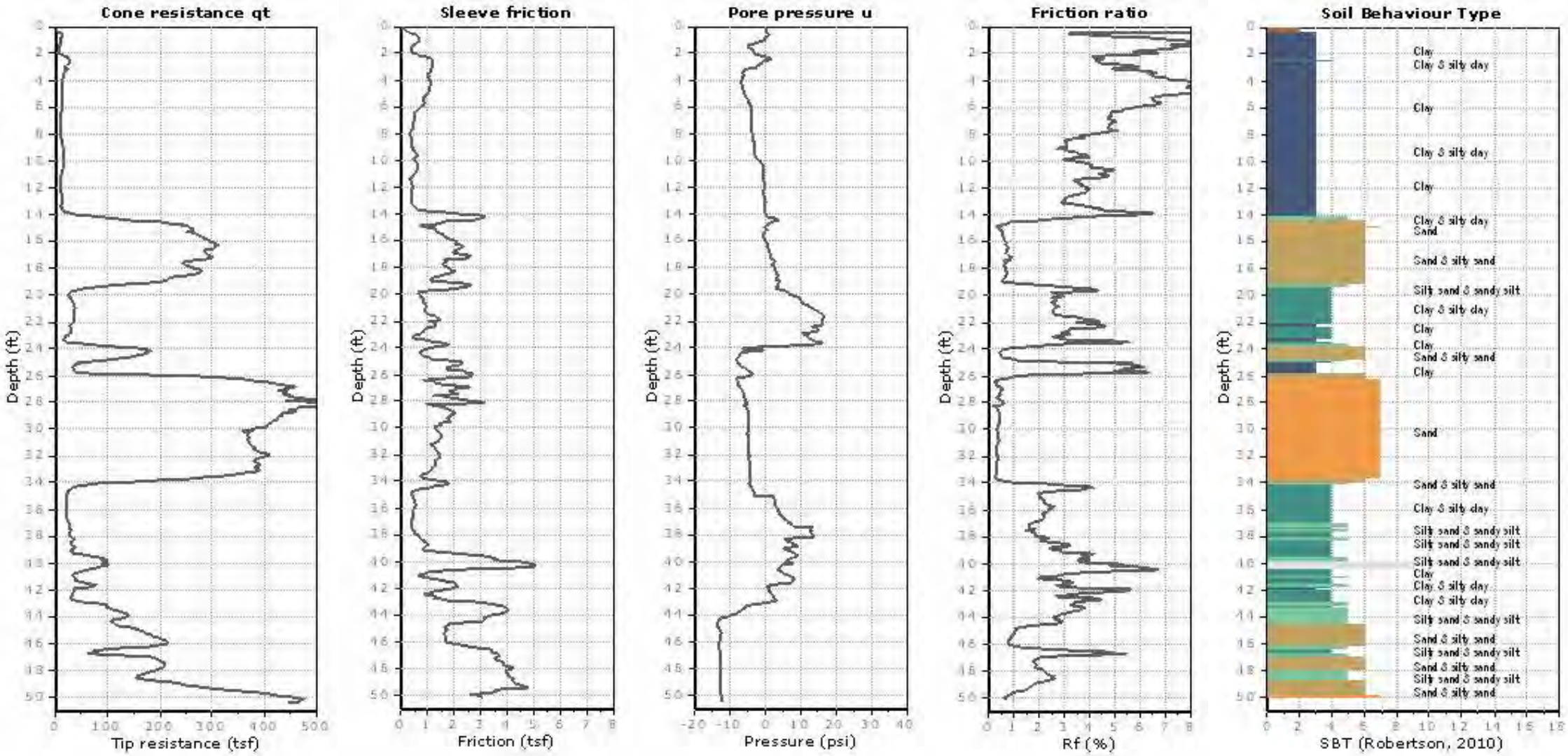
Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

CPT-1

Project: **GMU Geotechnical / EF International**
Location: **3150 Bear St, Costa Mesa, CA**

Total depth: 50.46 ft, Date: 1/2/2019
Cone Type: Vertek

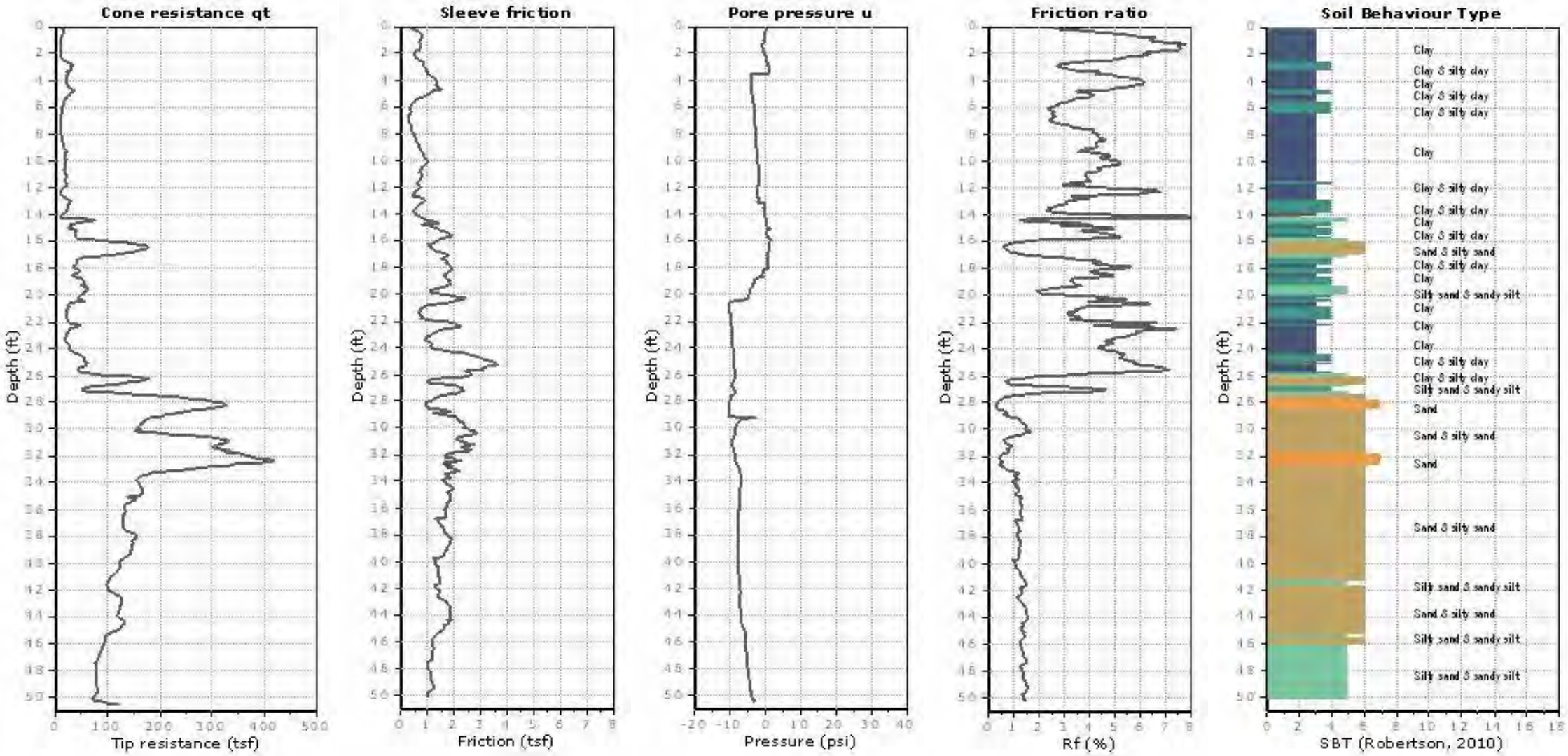


Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

CPT-2A

Project: **GMU Geotechnical / EF International**
Location: **3150 Bear St, Costa Mesa, CA**

Total depth: 50.54 ft, Date: 1/2/2019
Cone Type: Vertek



Kehoe Testing and Engineering
714-901-7270
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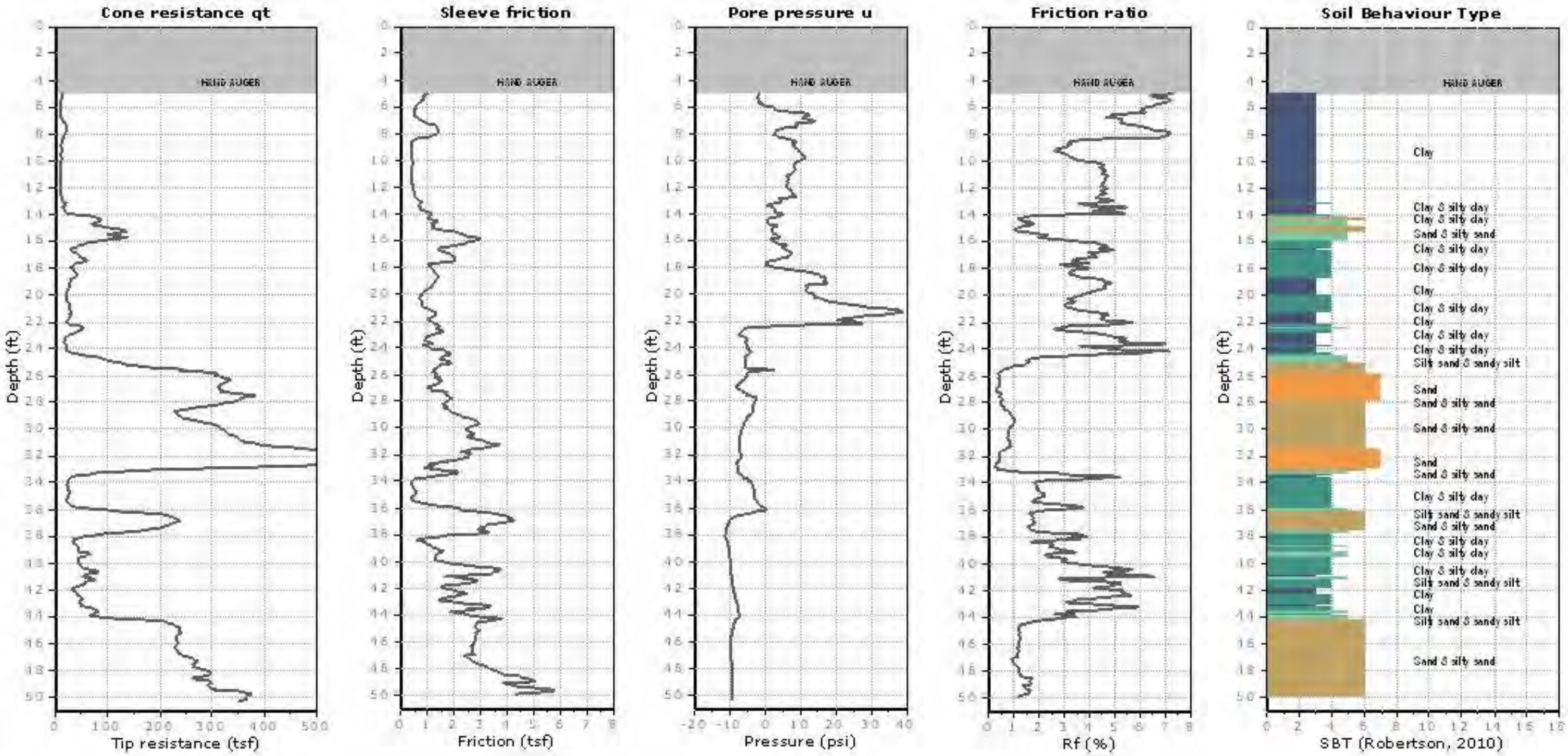
CPT-3A

Project: **GMU Geotechnical / EF International**
Location: **3150 Bear St, Costa Mesa, CA**

Total depth: 50.34 ft, Date: 1/2/2019
Cone Type: Vertek

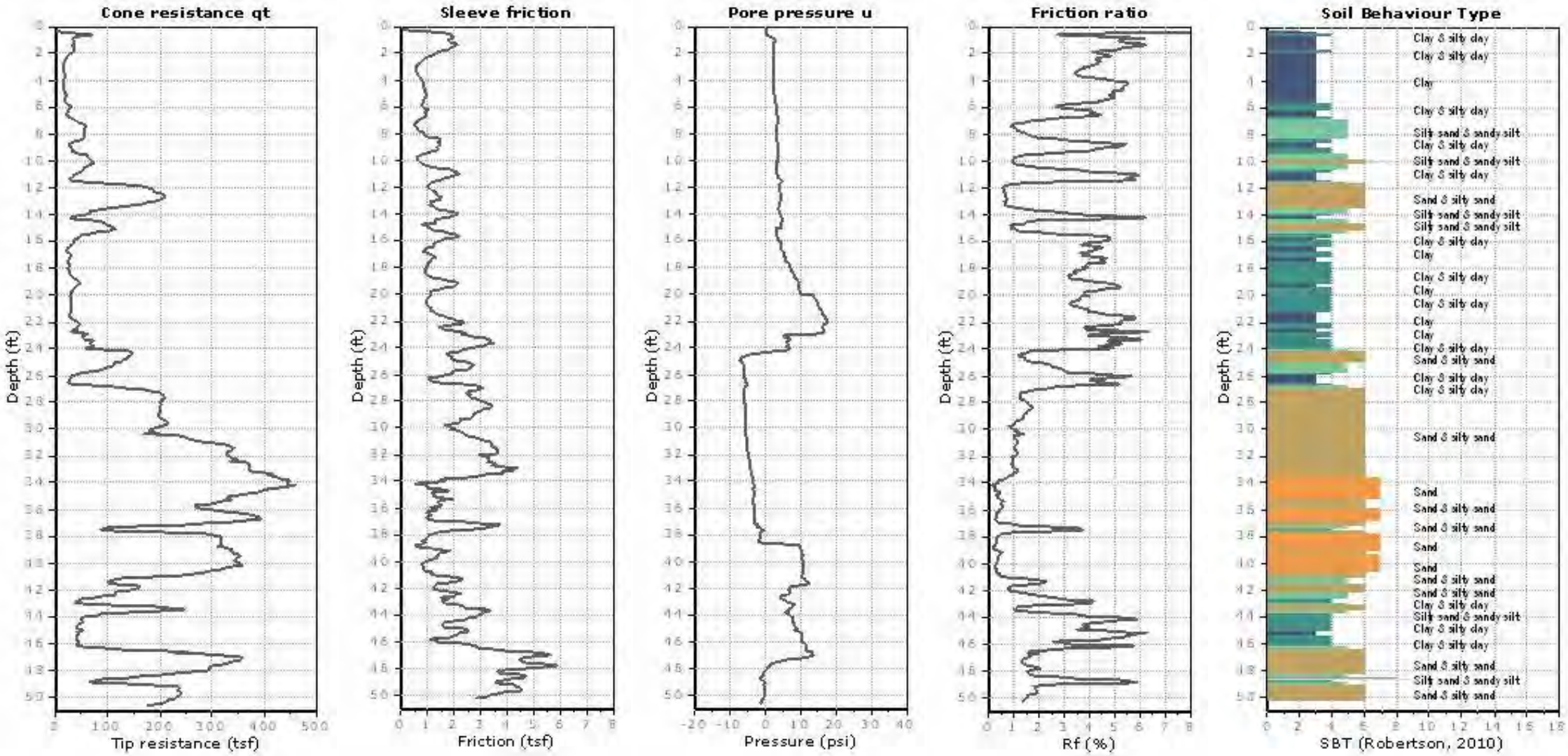


Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

CPT-4

Project: **GMU Geotechnical / EF International**
Location: **3150 Bear St, Costa Mesa, CA**

Total depth: 50.61 ft, Date: 1/2/2019
Cone Type: Vertek



APPENDIX B

Geotechnical Laboratory Procedures and Test Results by GMU Geotechnical, Inc.

GMU
GEOTECHNICAL, INC.

APPENDIX B

GMU GEOTECHNICAL LABORATORY PROCEDURES AND TEST RESULTS

MOISTURE AND DENSITY

Field moisture content and in-place density were determined for selected 6-inch sample sleeve of undisturbed soil material obtained from the drill holes. The field moisture content was determined in general accordance with ASTM Test Method D 2216 by obtaining one-half the moisture sample from each end of the 6-inch sleeve. The in-place dry density of the sample was determined by using the wet weight of the entire sample.

At the same time the field moisture content and in-place density were determined, the soil material at each end of the sleeve was classified according to the Unified Soil Classification System. The results of the field moisture content and in-place density determinations are presented on the right-hand column of the Log of Drill Hole and are summarized on Table B-1. The results of the visual classifications were used for general reference.

PARTICLE SIZE DISTRIBUTION

As part of the engineering classification of the materials underlying the site, some samples were tested to determine the distribution of particle sizes. The distribution was determined in general accordance with ASTM Test Method D 422 using U.S. Standard Sieve Openings 3", 1.5", 3/4, 3/8, and U.S. Standard Sieve Nos. 4, 10, 20, 40, 60, 100, and 200. In addition, on some samples a standard hydrometer test was performed to determine the distribution of particle sizes passing the No. 200 sieve (i.e., silt and clay-size particles). The results of the tests are contained in this Appendix B. Key distribution categories (% gravel; % sand, etc.) are contained on Table B-1.

ATTERBERG LIMITS

As part of the engineering classification of the soil material, some samples of the on-site soil material were tested to determine relative plasticity. This relative plasticity is based on the Atterberg limits determined in general accordance with ASTM Test Method D 4318. The results of these tests are contained in this Appendix B and also Table B-1.

CHEMICAL TESTS

The corrosion potential of typical on-site materials under long-term contact with both metal and concrete was determined by chemical and electrical resistance tests. The soluble sulfate test for potential concrete corrosion was performed in general accordance with California Test Method 417, the minimum resistivity test for potential metal corrosion was performed in general accordance with California Test Method 643, and the concentration of soluble chlorides was determined in general accordance with California Test Method 422. The results of these tests are contained in Table B-1.

COMPACTION TESTS

A bulk sample representative of the on-site materials was tested to determine the maximum dry density and optimum moisture content of the soil. These compactive characteristics were determined in general accordance with ASTM Test Method D 1557. The results of this test are contained in this Appendix B and also Table B-1.

CONSOLIDATION TESTS

The one-dimensional consolidation properties of "undisturbed" samples were evaluated in general accordance with the provisions of ASTM Test Method D 2435. Sample diameter was 2.416 inches and sample height was 1.00 inch. Water was added during the test at various normal loads to evaluate the potential for hydro-collapse and to produce saturation during the remainder of the testing. Consolidation readings were taken regularly during each load increment until the change in sample height was less than approximately 0.0001 inch over a two-hour period. The graphic presentation of consolidation data is a representation of volume change in change in axial load. The results of these tests are contained in this Appendix B.

DIRECT SHEAR STRENGTH TESTS

Direct shear tests were performed on typical on-site materials. The general philosophy and procedure of the tests were in accord with ASTM Test Method D 3080 - "Direct Shear Tests for Soils Under Consolidated Drained Conditions".

The tests are single shear tests and are performed using a sample diameter of 2.416 inches and a height of 1.00 inch. The normal load is applied by a vertical dead load system. A constant rate of strain is applied to the upper one-half of the sample until failure occurs. Shear stress is monitored by a strain gauge-type precision load cell and deflection is measured with a digital dial indicator. This data is transferred electronically to data acquisition software which plots shear strength vs. deflection. The shear strength plots are then interpreted to determine either

peak or ultimate shear strengths. Residual strengths were obtained through multiple shear box reversals. A strain rate compatible with the grain size distribution of the soils was utilized. The interpreted results of these tests are shown in this Appendix B.

R-VALUE TESTS

A bulk sample representative of the underlying on-site materials was tested to measure the response of a compacted sample to a vertically applied pressure under specific conditions. The R-value of a material is determined when the material is in a state of saturation such that water will be exuded from the compacted test specimen when a 16.8 kN load (2.07 MPa) is applied. The results from these test procedures are reported in Table B-1.

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information								Sieve/Hydrometer				Atterberg Limits			Compaction				Chemical Test Results			
Boring Number	Depth, feet	Elevation, feet	Geologic Unit	USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, pcf	In Situ Saturation, %	Gravel, %	Sand, %	<#200, %	<2μ, %	LL	PL	PI	Maximum Dry Unit Weight, pcf	Optimum Water Content, %	Expansion Index	R-Value	pH	Sulfate (ppm)	Chloride (ppm)	Min. Resistivity (ohm/cm)
DH-1	0	34.7	Qya	CL													121		7.8	68	696	692
DH-1	2.5	32.2	Qya	CH	21.3	101	89															
DH-1	5	29.7	Qya	CH	38.1	82	99															
DH-1	7.5	27.2	Qya	CH	30.3	89	93															
DH-1	10	24.7	Qya	CH	28.3	94	100															
DH-1	12.5	22.2	Qya	CL	15.6	113	89															
DH-1	15	19.7	Qya	SP-SM	4.0			11	78	11	5	NP	NP	NP								
DH-1	20	14.7	Qya	CL	20.5	107	99															
DH-1	30	4.7	Qya	SP-SM	8.1	136	97															
DH-2	0	35.3	Qal/Qt	CL											113.5	15.5						
DH-2	2.5	32.8	Qya	CH	23.2	99	93															
DH-2	5	30.3	Qya	CH	28.0	92	93					61	21	40								
DH-2	7.5	27.8	Qya	CH	15.2	117	96															
DH-2	10	25.3	Qya	CH	20.6	106	99															
DH-2	12.5	22.8	Qya	ML	16.5	115	100															
DH-2	15	20.3	Qya	CL	26.3	100	106															
DH-2	25	10.3	Qya	SM	17.4	114	101															
DH-3	2.5	32.2	Qya	CL	19.4	108	97															
DH-4	0	34.7	Qya	CL													129		7.4	2943	936	515
DH-4	2.5	32.2	Qya	CH	24.3	99	96															
DH-4	5	29.7	Qya	CH	28.4	86	81	0	3	97	69	97	31	66								
DH-4	7.5	27.2	Qya	CH	32.1	84	88															
DH-4	10	24.7	Qya	CL	17.0	113	97															
DH-4	12.5	22.2	Qya	CL	17.0	108	86															
DH-4	20	14.7	Qya	CL	16.2	112	91															

Project: EF International Language Campus
Project No. 18-252-00

GMU GEOTECHNICAL, INC.

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information								Sieve/Hydrometer				Atterberg Limits			Compaction				Chemical Test Results			
Boring Number	Depth, feet	Elevation, feet	Geologic Unit	USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, pcf	In Situ Saturation, %	Gravel, %	Sand, %	<#200, %	<2μ, %	LL	PL	PI	Maximum Dry Unit Weight, pcf	Optimum Water Content, %	Expansion Index	R-Value	pH	Sulfate (ppm)	Chloride (ppm)	Min. Resistivity (ohm/cm)
DH- 4	30	4.7	Qya	SP	15.6	118	102															
DH- 5	0	34.7	Qya	CL											114.0	14.0	120		8.5	443	696	692
DH- 5	2.5	32.2	Qya	CL	9.9	105	45															
DH- 5	5	29.7	Qya	CL	5.9	120	41															
DH- 5	7.5	27.2	Qya	CL	11.1	124	87															
DH- 5	10	24.7	Qya	SC	7.6	114	45															
DH- 5	12.5	22.2	Qya	SM	5.4	107	26															
DH- 5	15	19.7	Qya	CL	20.4	104	93															
DH- 5	20	14.7	Qya	CL	26.2	95	94															
DH- 5	30	4.7	Qya	SP-SM				0	90	10	5											
DH- 6	2.5	33.5	Qya	CL	15.0	107	72															
DH- 6	5	31.0	Qya	CH	29.5	77	68															
DH- 7	2.5	31.0	Qya	CH	38.8	82	101															
DH- 8	2.5	32.9	Qya	CL	22.5	94	78															
DH- 8	5	30.4	Qya	CH	15.5	90	49															
DH- 9	0	34.0	Qya	CL														8				
DH-10	0	34.6	Qya	CL											124.0	11.5						
DH-10	2.5	32.1	Qya	CL	10.7	98	41															
DH-10	5	29.6	Qya	CL	21.2	104	94															
DH-10	7.5	27.1	Qya	CL	10.4	122	77															
DH-10	10	24.6	Qya	CL	10.2	124	80															
DH-10	12.5	22.1	Qya	SC	4.1	119	28															
DH-10	15	19.6	Qya	CL	10.9	122	81															
DH-10	25	9.6	Qya	SG	10.5	130	103															
DH-11	2.5	31.2	Qya	CL	14.2	118	93															

Project: EF International Language Campus
Project No. 18-252-00

GMU GEOTECHNICAL, INC.

GMU_TABLE_SOIL_LAB_DATA 18-252-00.GPJ FNC AB GWGN01.GDT 1/30/19

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information								Sieve/Hydrometer				Atterberg Limits			Compaction				Chemical Test Results			
Boring Number	Depth, feet	Elevation, feet	Geologic Unit	USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, pcf	In Situ Saturation, %	Gravel, %	Sand, %	<#200, %	<2μ, %	LL	PL	PI	Maximum Dry Unit Weight, pcf	Optimum Water Content, %	Expansion Index	R-Value	pH	Sulfate (ppm)	Chloride (ppm)	Min. Resistivity (ohm/cm)
DH-11	7.5	26.2	Qya	CL	14.0	114	83															
DH-11	12.5	21.2	Qya	SC	8.5	110	44															
DH-11	20	13.7	Qya	SM	20.9	110	109															
DH-11	30	3.7	Qya	SP	22.2	102	95															

Project: EF International Language Campus
Project No. 18-252-00

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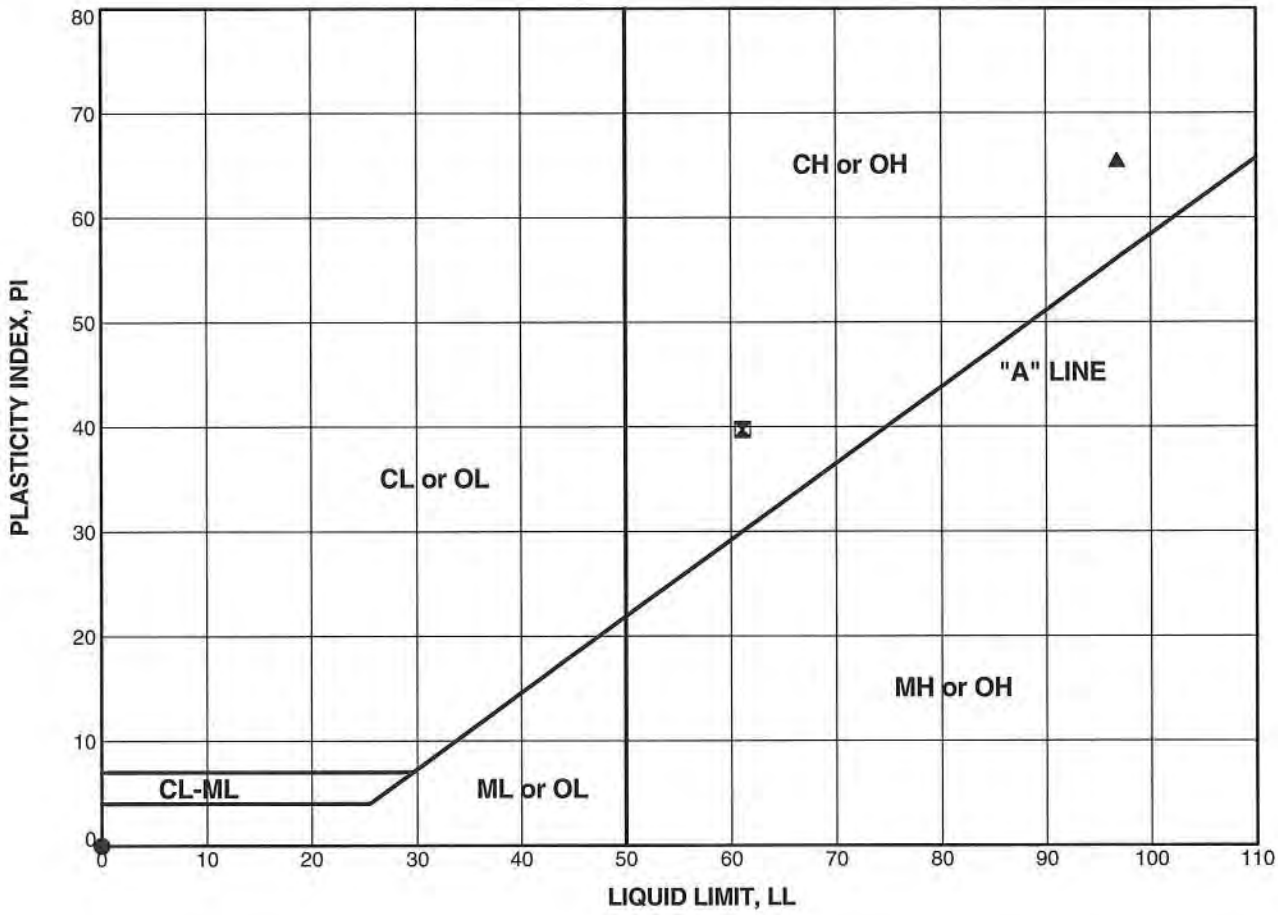
GMU_TABLE_SOIL_LAB_DATA 18-252-00.GPJ FNC AB GWGN01.GDT 1/30/19



Boring Number	Depth (feet)	Geologic Unit	Test Symbol	Water Content (%)	LL	PL	PI	Classification
DH- 1	15.0	Qya	●	4	NP	NP	NP	POORLY GRADED SAND WITH SILT (SP-SM)
DH- 2	5.0	Qya	⊠	28	61	21	40	FAT CLAY (CH)
DH- 4	5.0	Qya	▲	28	97	31	66	FAT CLAY (CH)

GMU_ATTERBERG_LIMITS_12 PTS 18-252-00.GPJ GM&U.GDT 1/30/19

ATTERBERG LIMITS

Project: EF International Language Campus

Project No. 18-252-00

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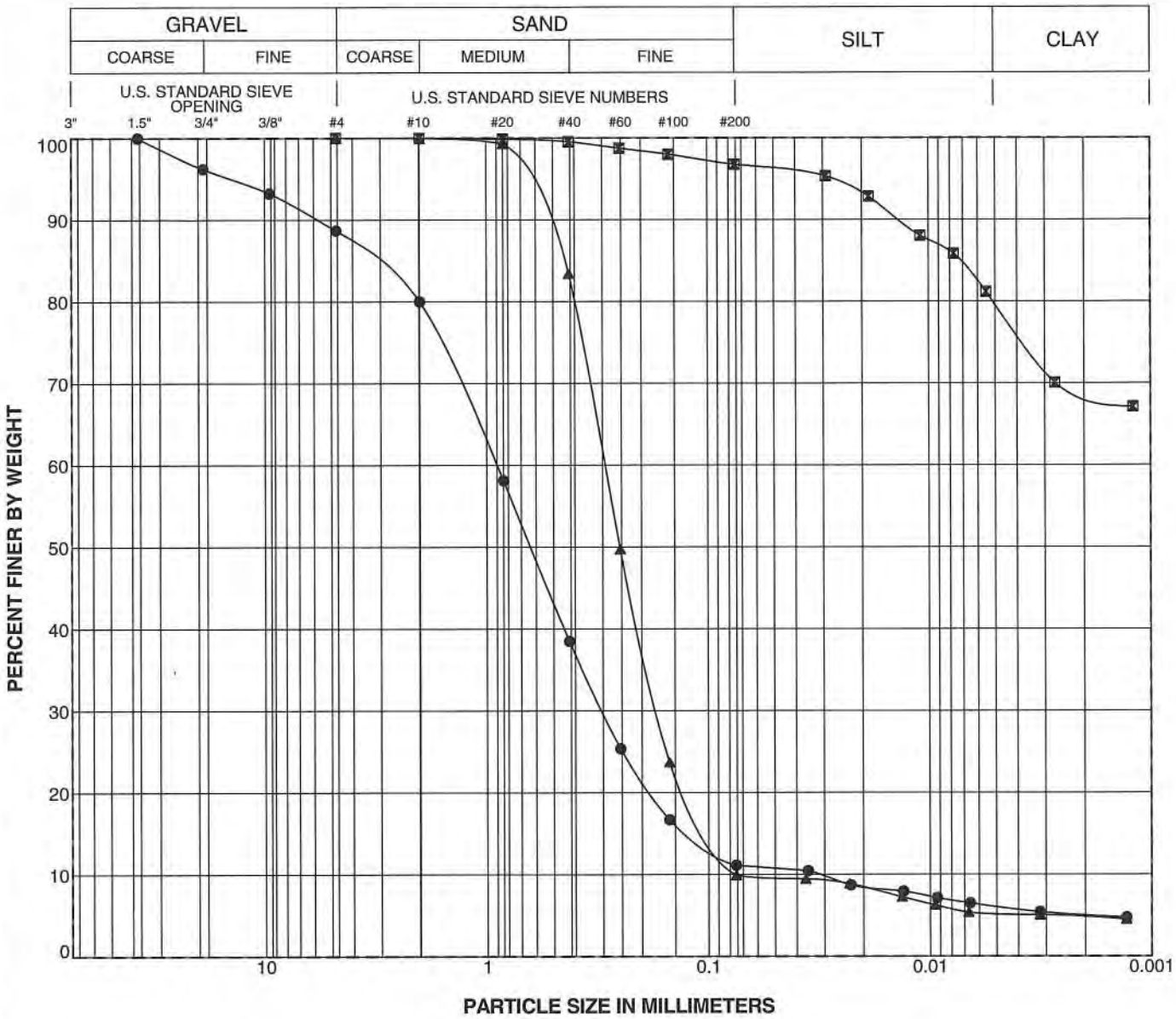

Boring Number	Depth (feet)	Geologic Unit	Symbol	LL	PI	Classification
DH- 1	15.0	Qya	●	NP	NP	POORLY GRADED SAND WITH SILT (SP-SM)
DH- 4	5.0	Qya	⊠	97	66	FAT CLAY (CH)
DH- 5	30.0	Qya	▲			POORLY GRADED SAND WITH SILT (SP-SM)

GMU_GRAIN_SIZE 18-252-00.GPJ 1/30/19

PARTICLE SIZE DISTRIBUTION

Project: EF International Language Campus

Project No. 18-252-00

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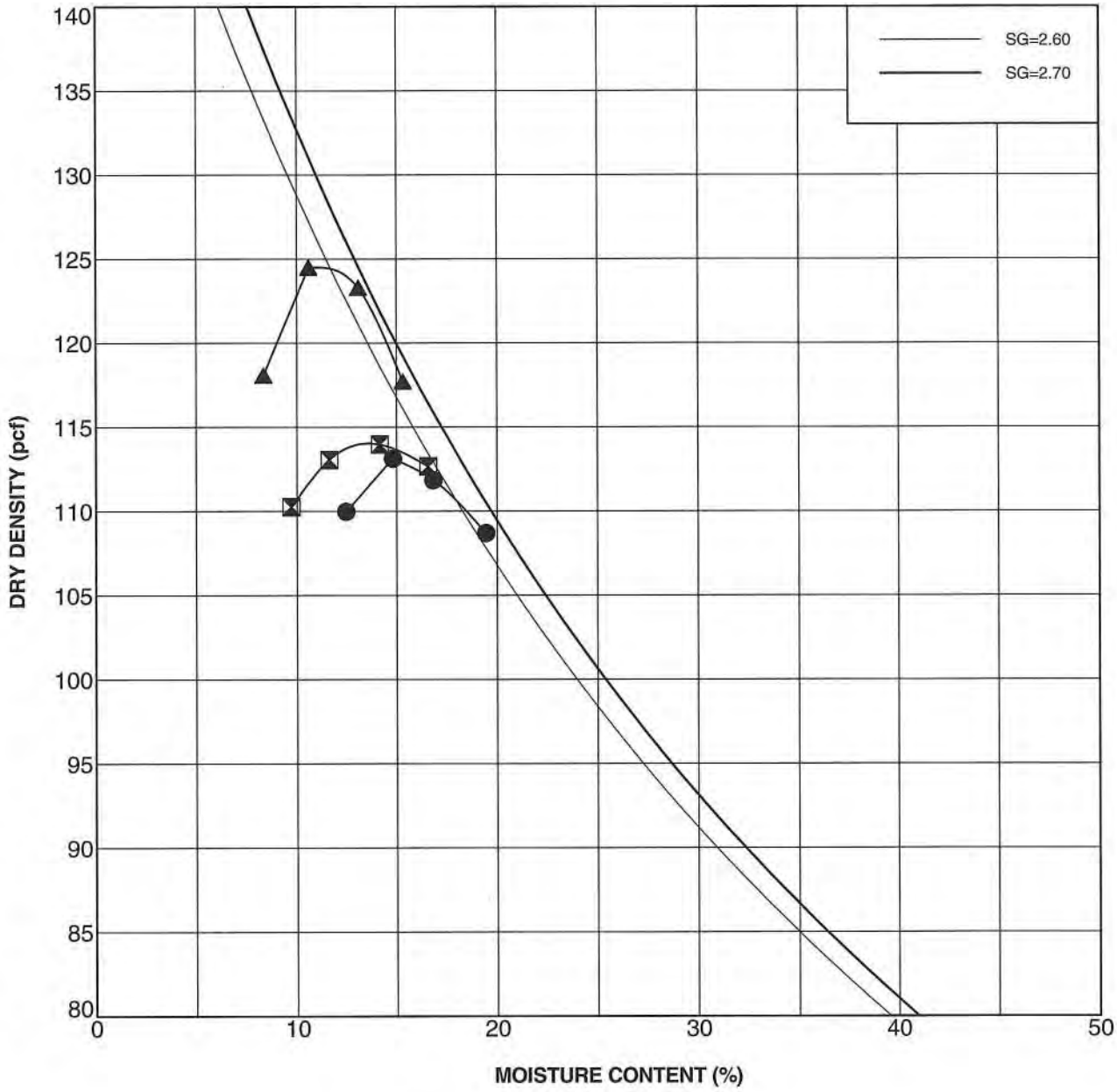


Boring Number	Depth (feet)	Geologic Unit	Symbol	Maximum Dry Density, pcf	Optimum Moisture Content, %	Classification
DH- 2	0.0	Qal/Qt	●	113.5	15.5	LEAN CLAY (CL)
DH- 5	0.0	Qya	⊠	114	14	SILTY CLAY (CL)
DH-10	0.0	Qya	▲	124	11.5	SITLY CLAY (CL)

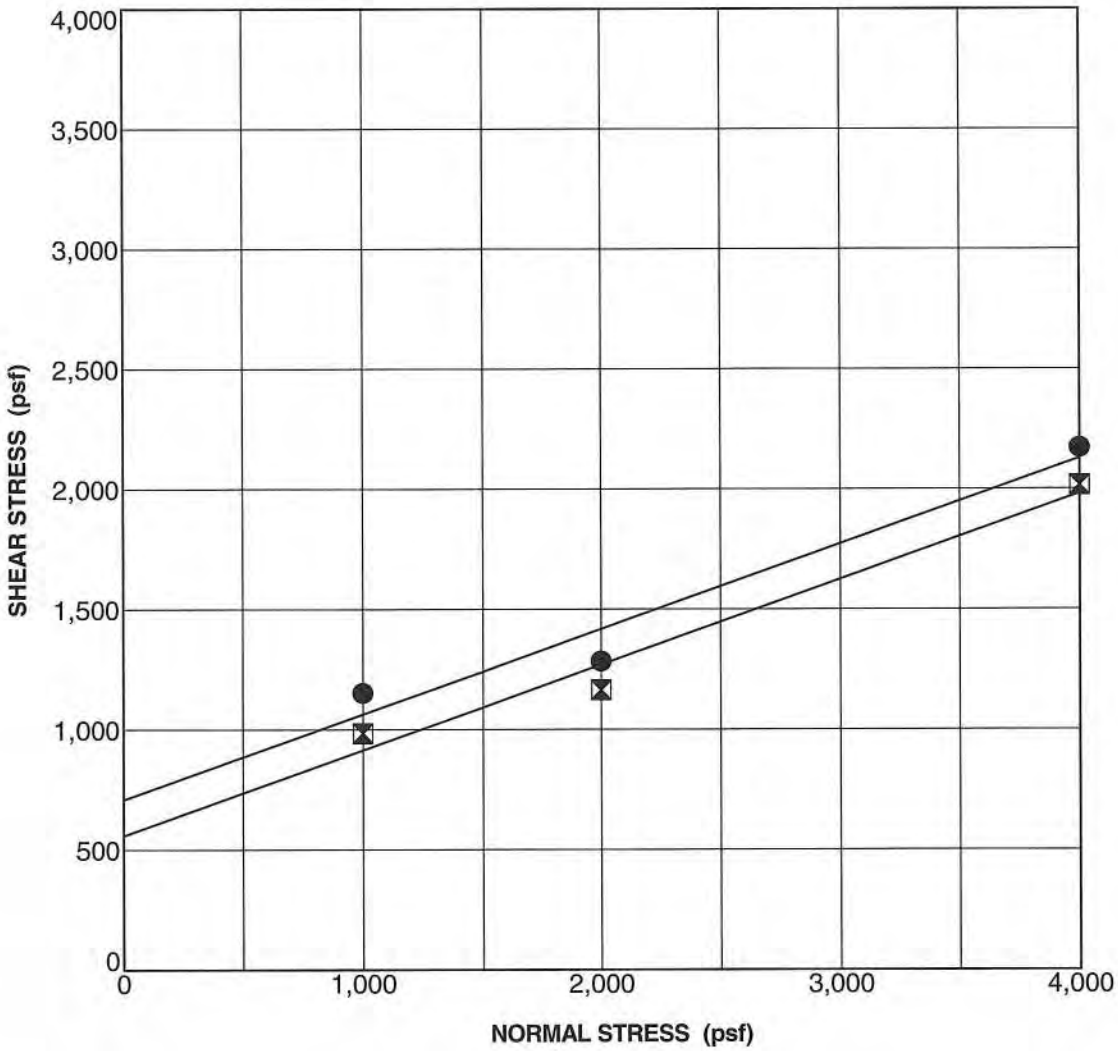
COMPACTION TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.

GMU_COMPACTION_4_SETS 18-252-00.GPJ 1/30/19



SAMPLE AND TEST DESCRIPTION
Sample Location: DH- 1 @ 2.5 ft **Geologic Unit:** Qya **Classification:** FAT CLAY (CH)
Strain Rate (in/min): 0.005 **Sample Preparation:** Undisturbed
Notes: Sample saturated prior and during shearing

STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	708	19.5
⊠ Ultimate Strength	558	19.5

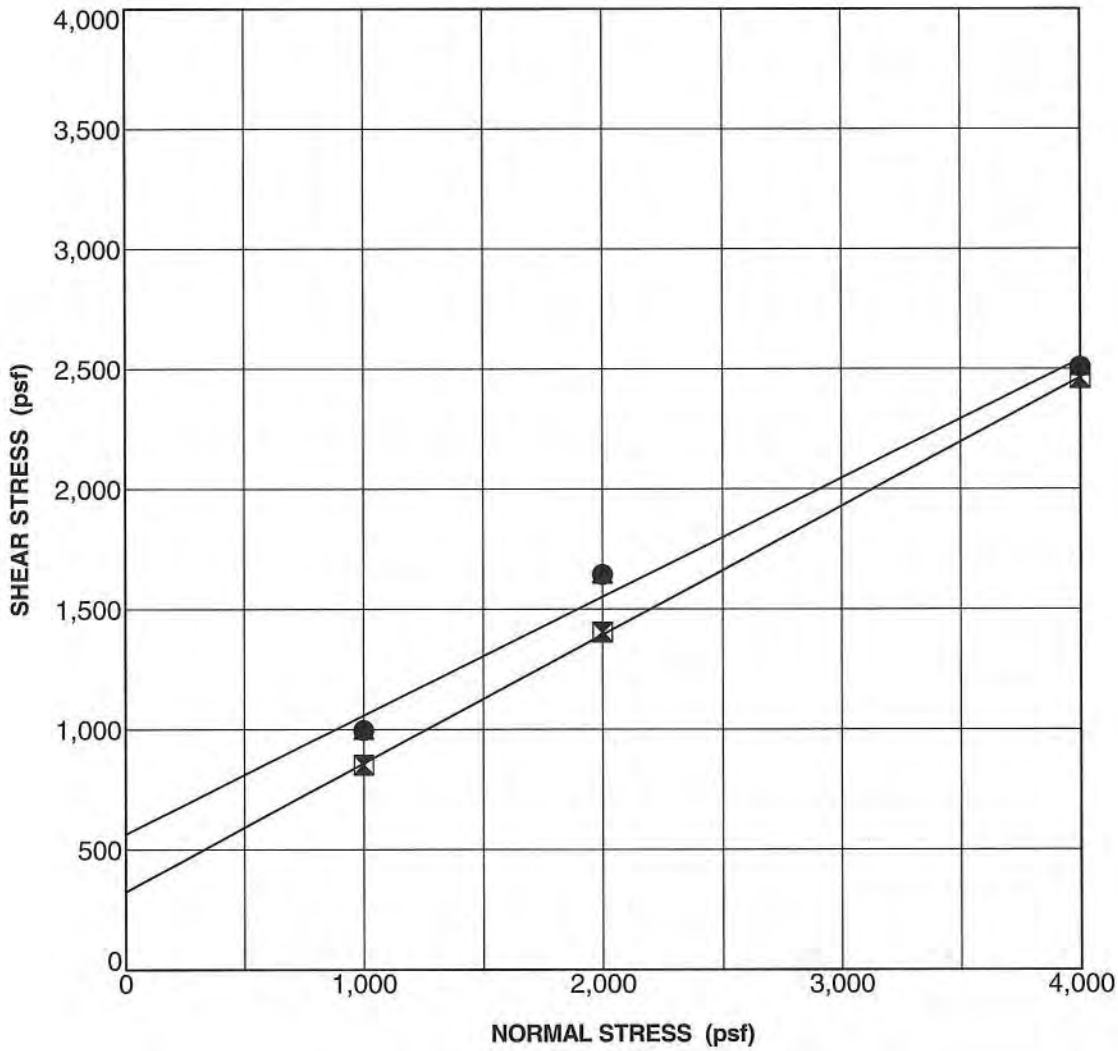
SHEAR TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.

GMU_DIRECT_SHEAR 18-252-00.GPJ GM&U.GDT 1/30/19



SAMPLE AND TEST DESCRIPTION
Sample Location: DH- 4 @ 0.0 ft **Geologic Unit:** Qya **Classification:** SILTY CLAY (CL)
Strain Rate (in/min): 0.005 **Sample Preparation:** Remolded
Notes:

STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	564	26.0
⊠ Ultimate Strength	324	28.1

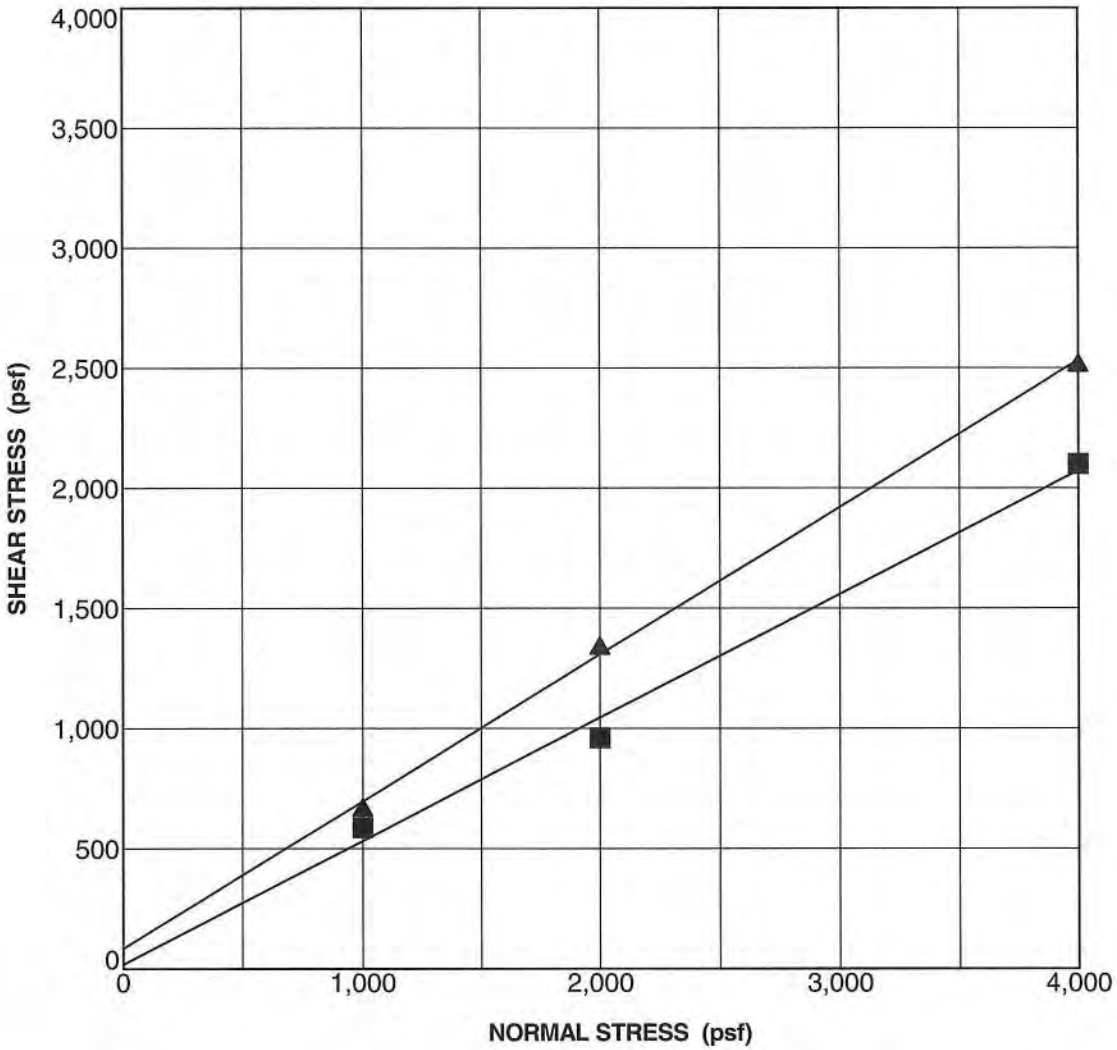
SHEAR TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.

GMU_DIRECT_SHEAR 18-252-00.GPJ GM&U.GDT 1/30/19



SAMPLE AND TEST DESCRIPTION
Sample Location: DH- 5 @ 5.0 ft **Geologic Unit:** Qya **Classification:** SILTY CLAY (CL)
Strain Rate (in/min): 0.005 **Sample Preparation:** Undisturbed
Notes: Sample saturated prior and during shearing

STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	84	31.0
⊠ Ultimate Strength	18	27.0

SHEAR TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

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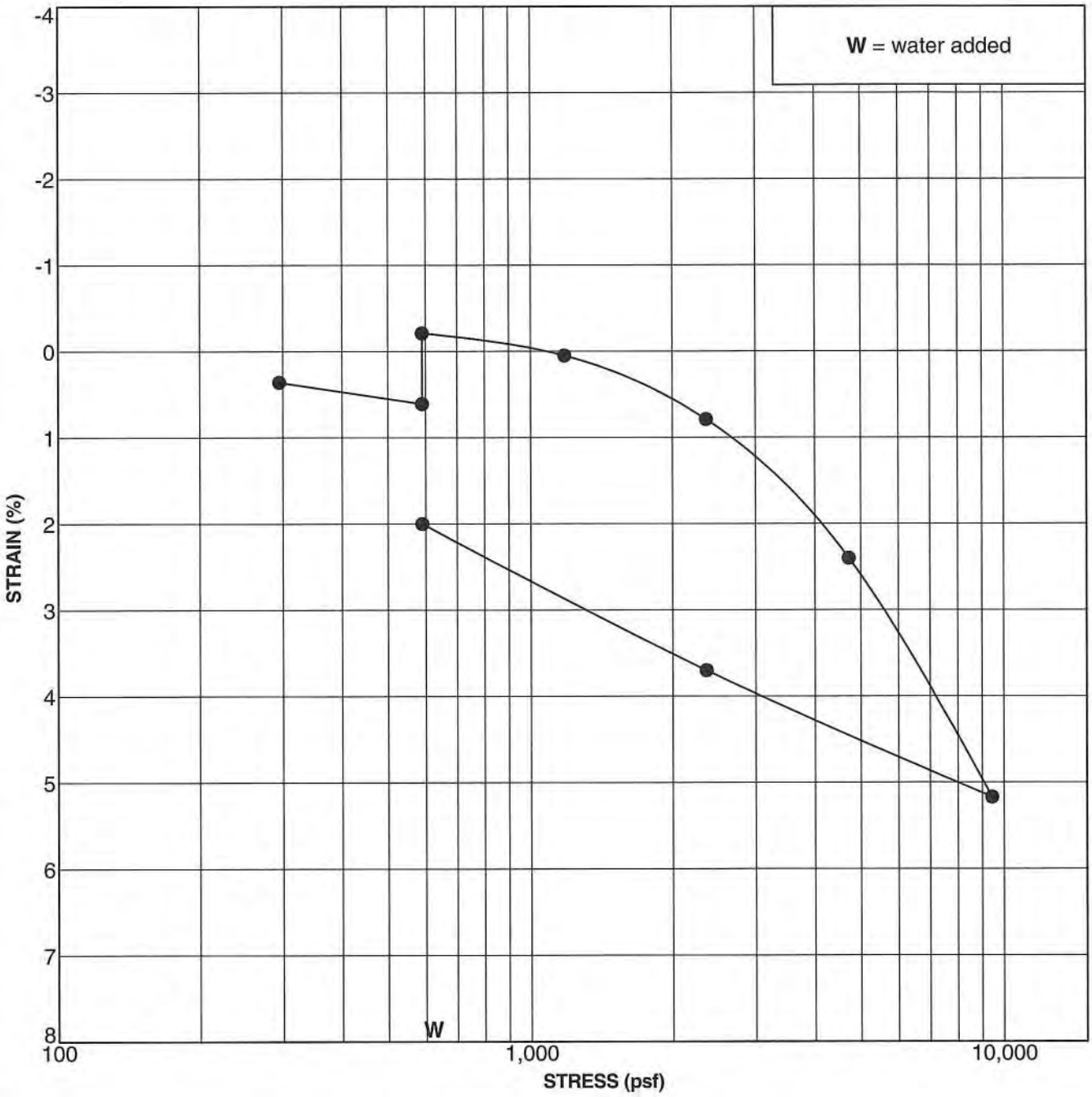
GMU_DIRECT_SHEAR 18-252-00.GPJ GM&U.GDT 1/30/19



Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH- 1	5.0	Qya	●	In Situ	-0.82	FAT CLAY (CH)

CONSOLIDATION TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

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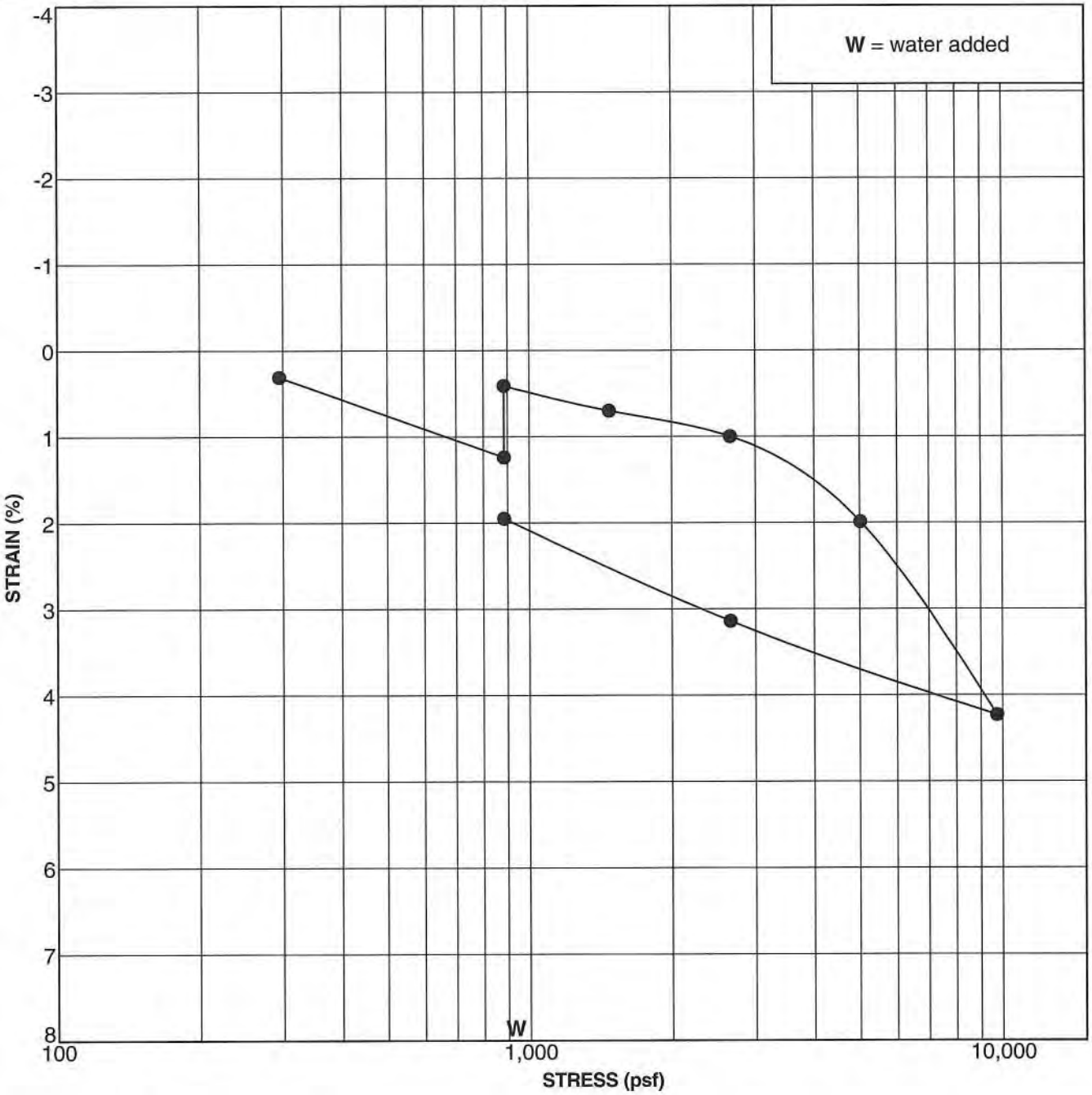
GMU_CONSOL 18-252-00.GPJ GM&U.GDT 1/30/19



Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH- 1	7.5	Qya	●	In Situ	-0.83	FAT CLAY (CH)

CONSOLIDATION TEST DATA

Project: EF International Language Campus

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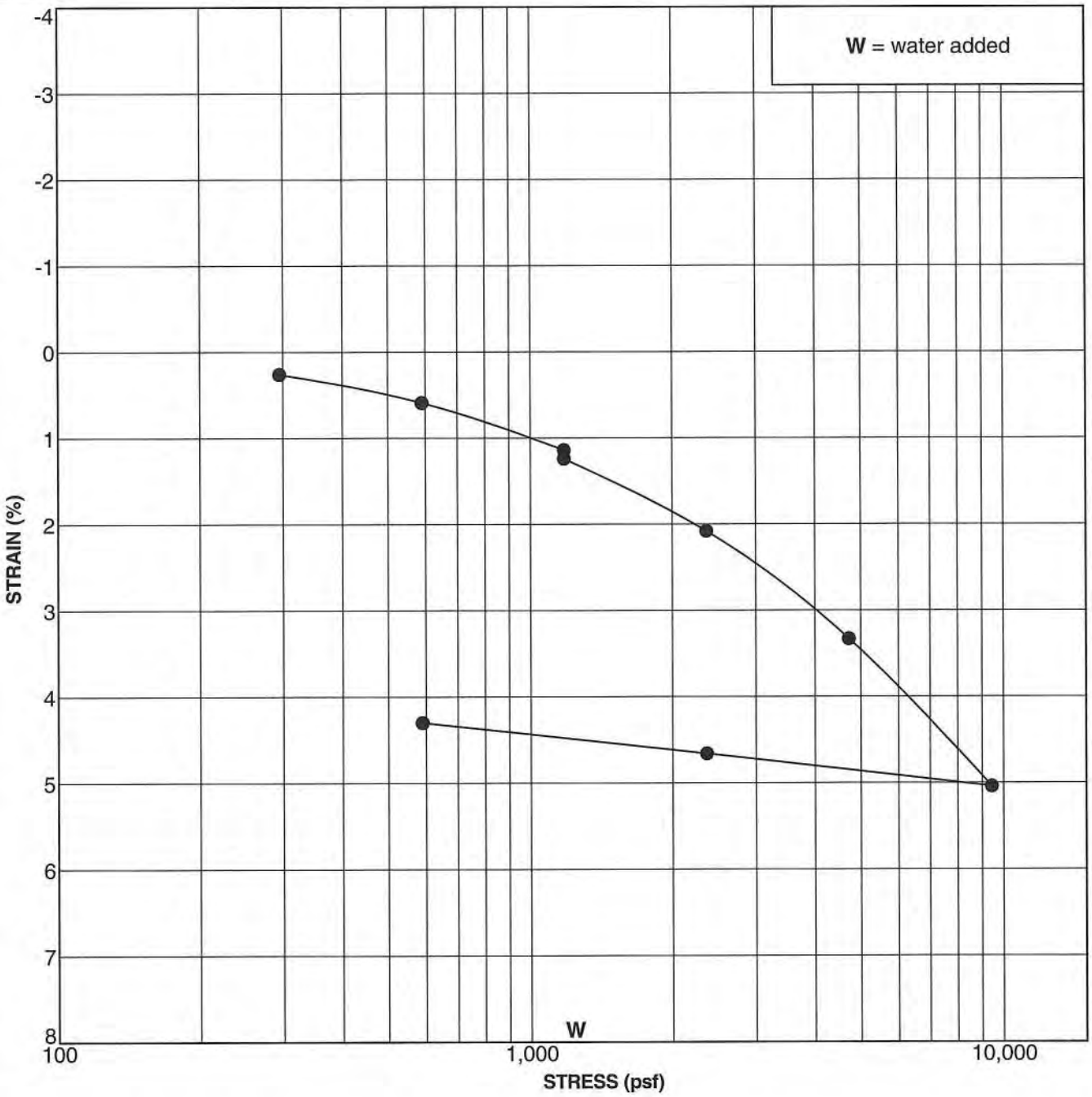

Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH- 2	10.0	Qya	●	In Situ	0.1	FAT CLAY (CH)

CONSOLIDATION TEST DATA

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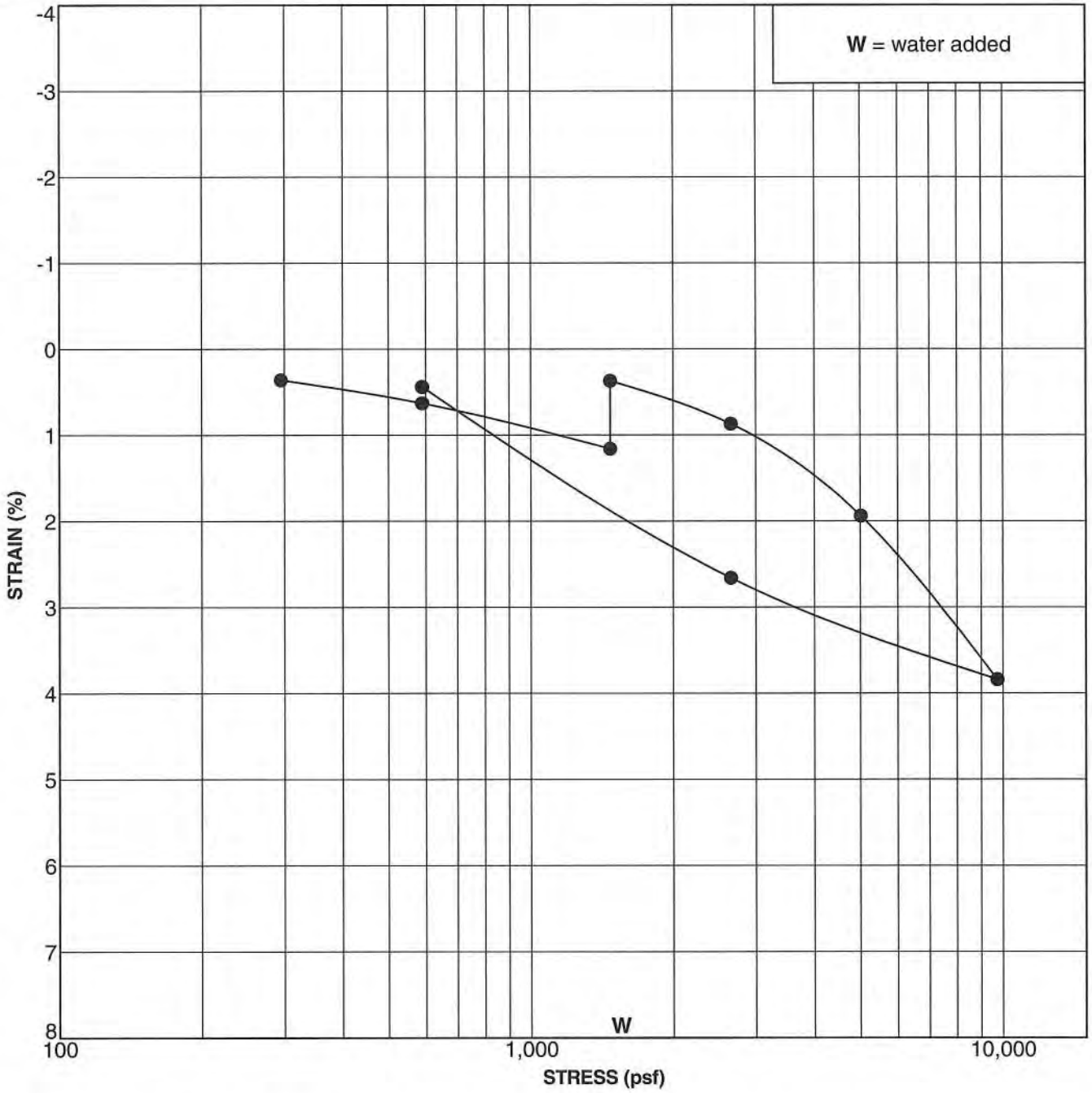

Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH- 4	12.5	Qya	●	In Situ	-0.79	LEAN CLAY (CL)

CONSOLIDATION TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

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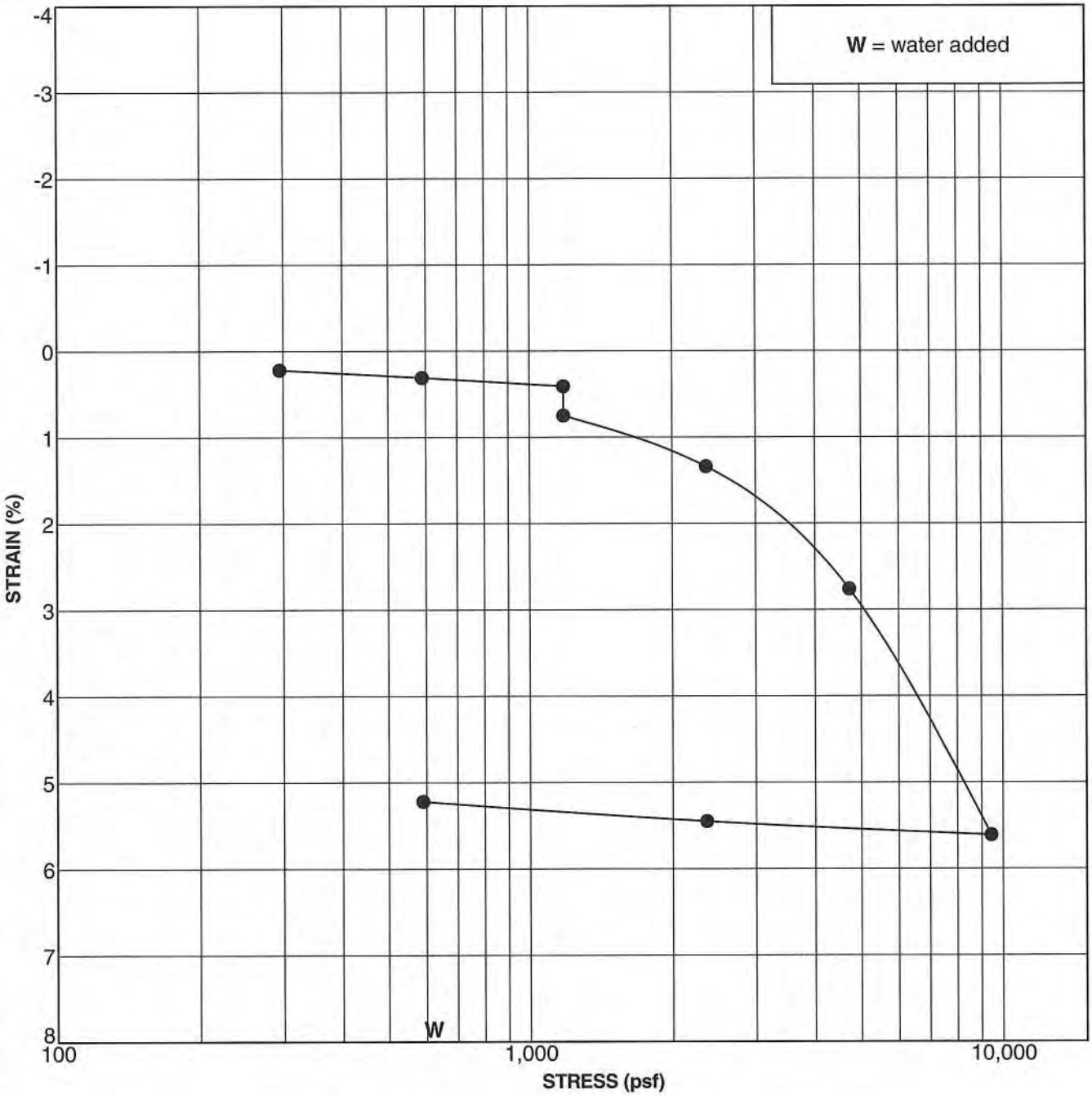
GMU_CONSOL 18-252-00.GPJ GM&U.GDT 1/30/19



Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH- 5	5.0	Qya	●	In Situ	0.34	SILTY CLAY (CL)

CONSOLIDATION TEST DATA

Project: EF International Language Campus

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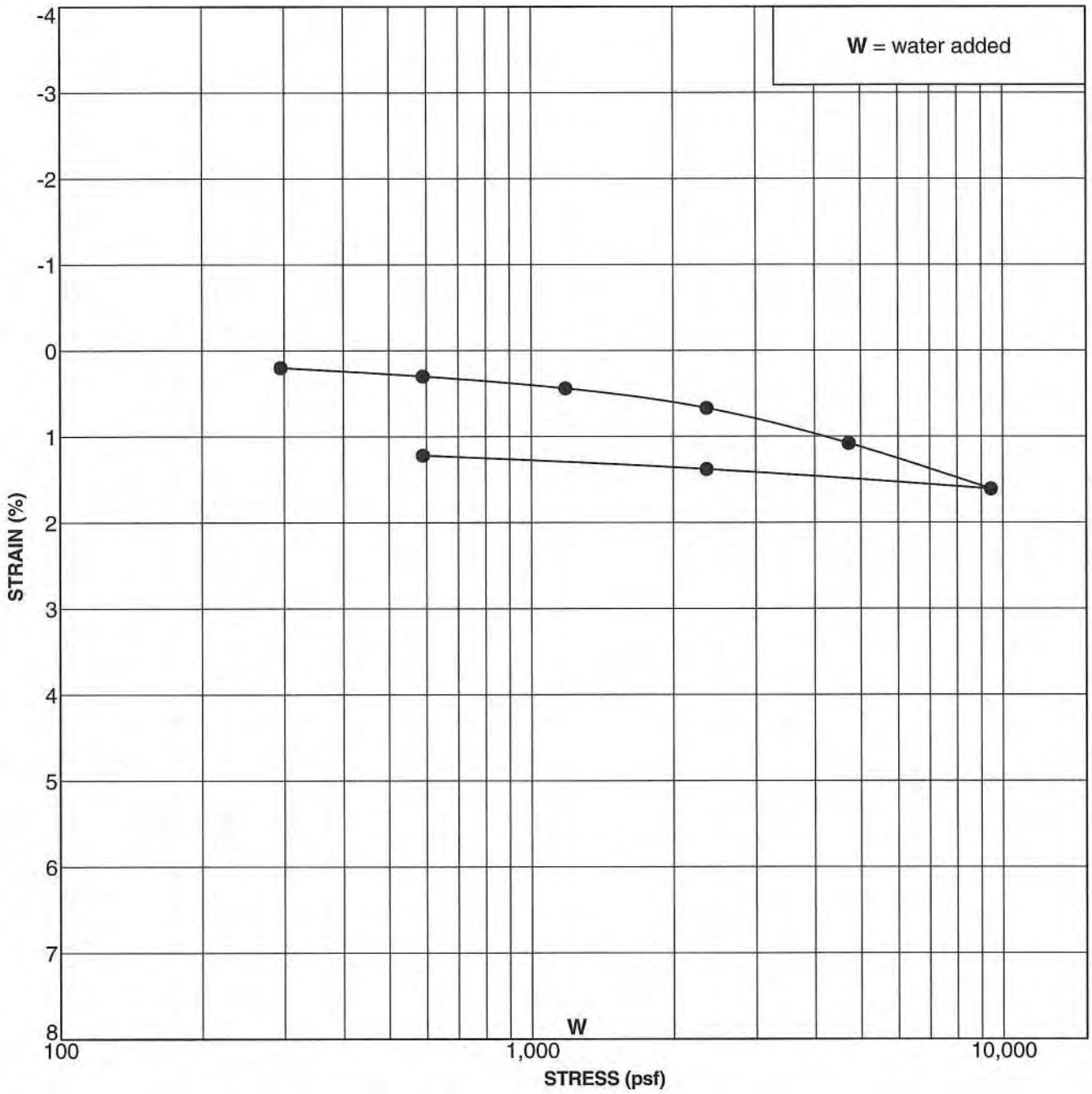

Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH-10	10.0	Qya	●	In Situ	0	SITLY CLAY (CL)

CONSOLIDATION TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

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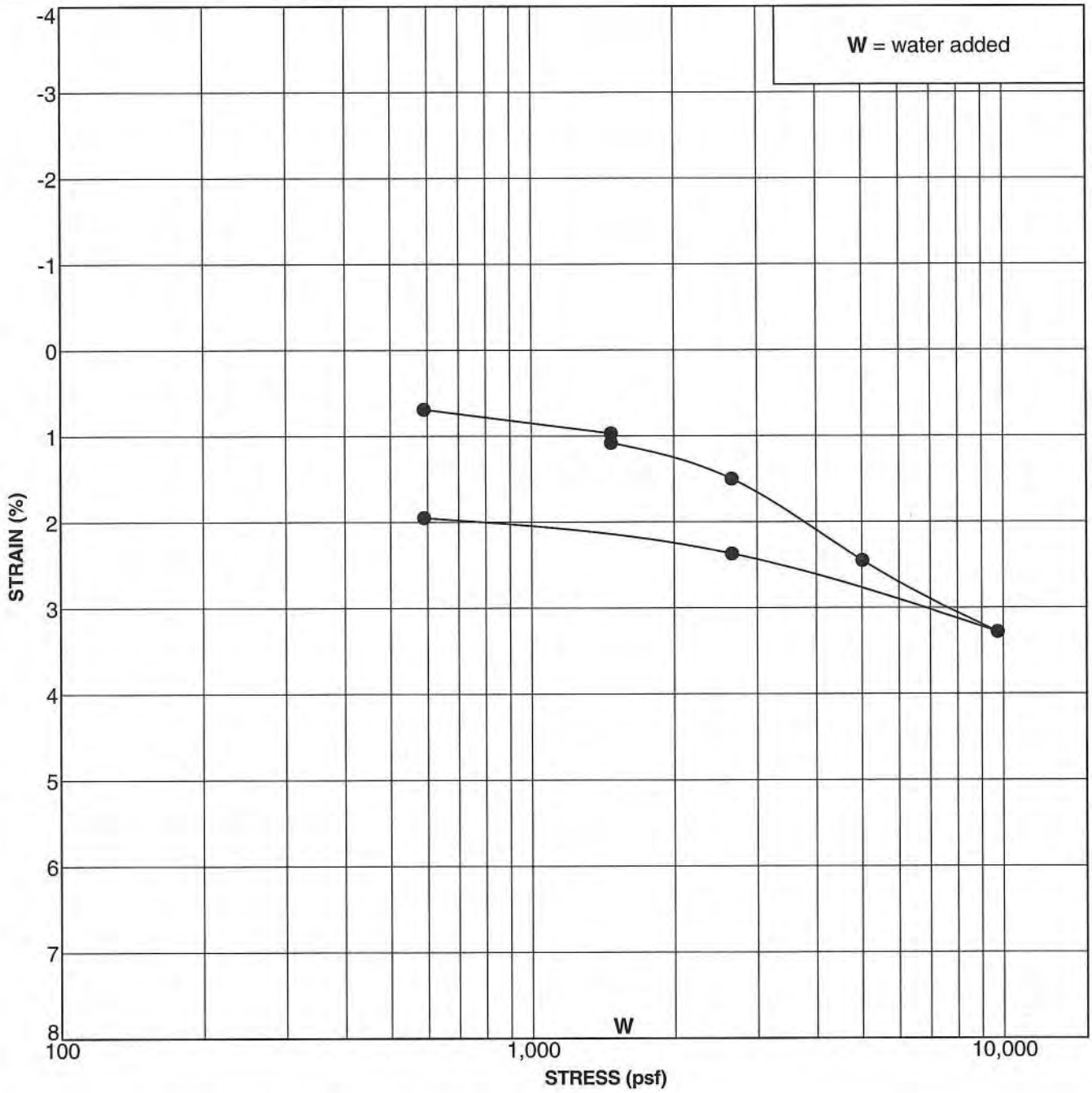

Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH-10	12.5	Qya	●	In Situ	11	CLAYEY SAND (SC)

CONSOLIDATION TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

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APPENDIX C

Liquefaction Analysis

GMU GEOTECHNICAL, INC.

GMU GEOTECHNICAL, INC.
23241 ARROYO VISTA
RANCHO SANTA MARGARITA, CA
www.GMUGEO.com

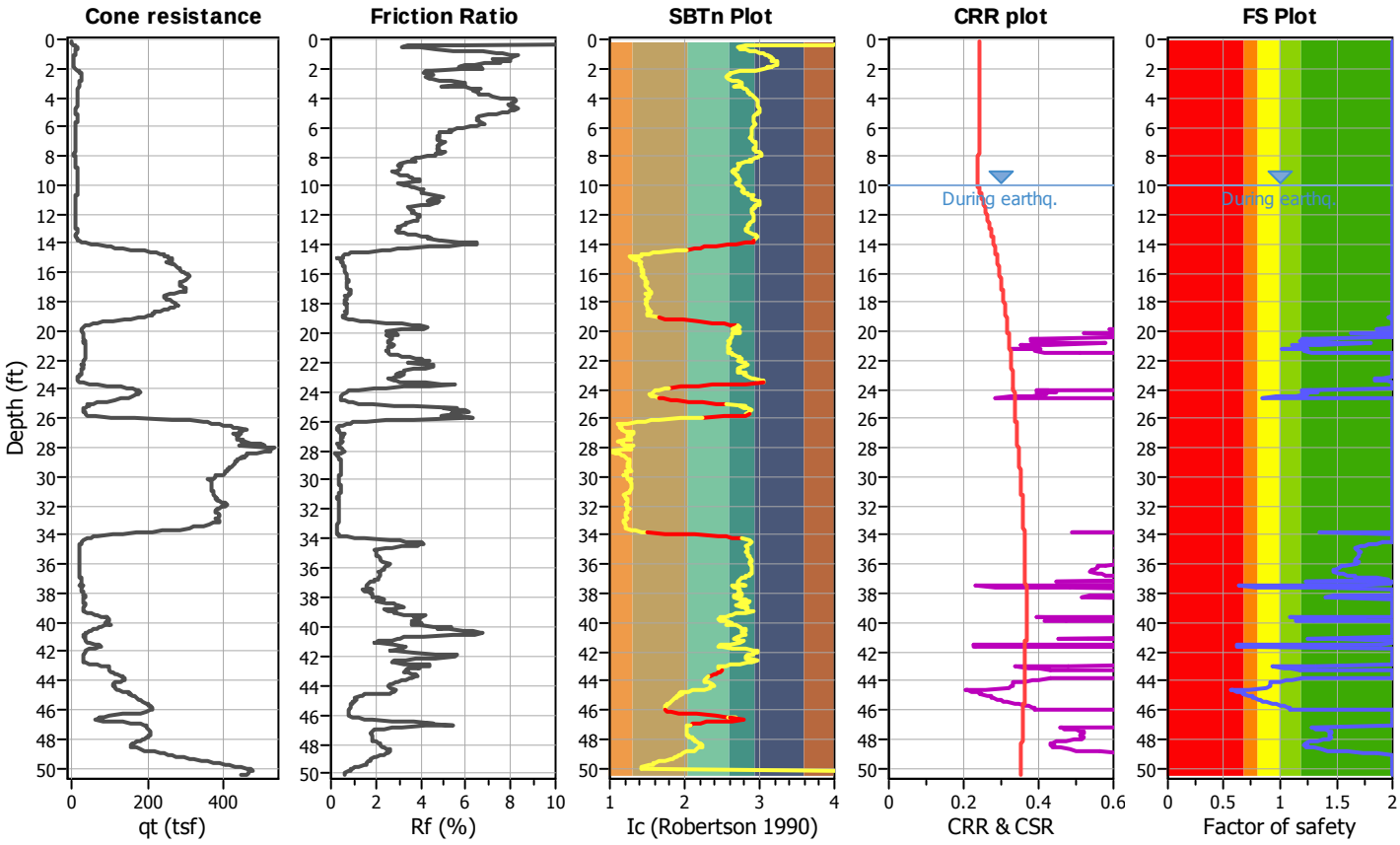
LIQUEFACTION ANALYSIS REPORT

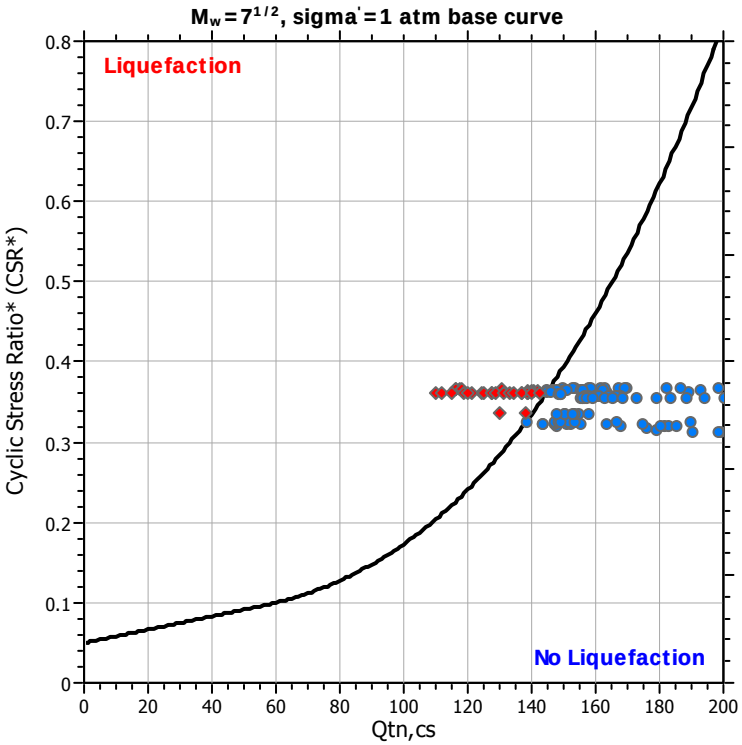
Project title : EF International Language Campus **Location : 3150 Bear St., Costa Mesa, CA**

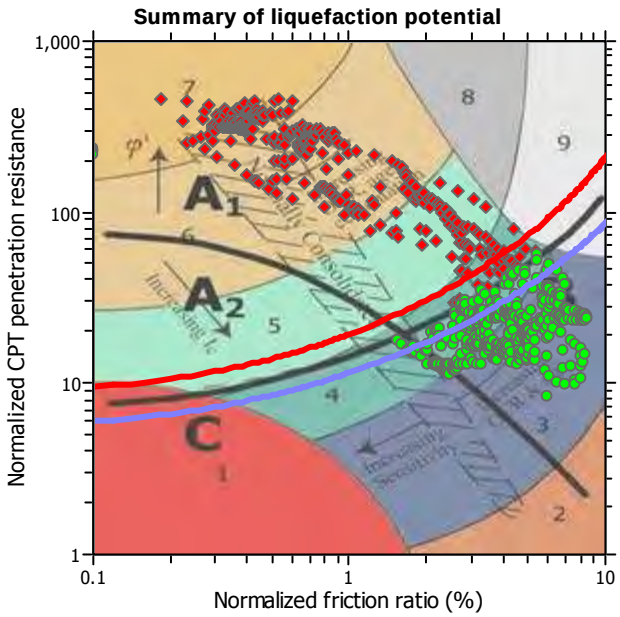
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	18.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.54	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

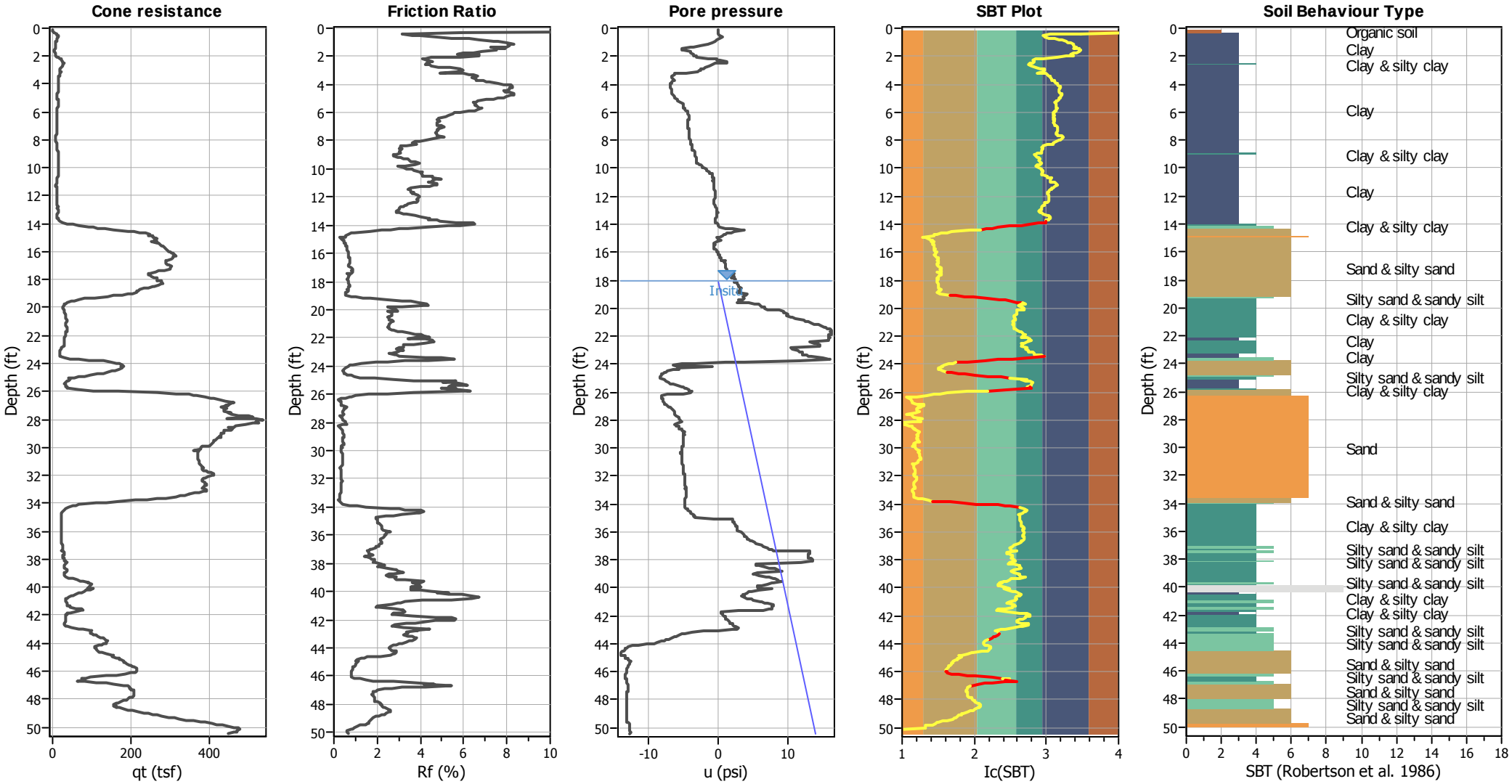






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



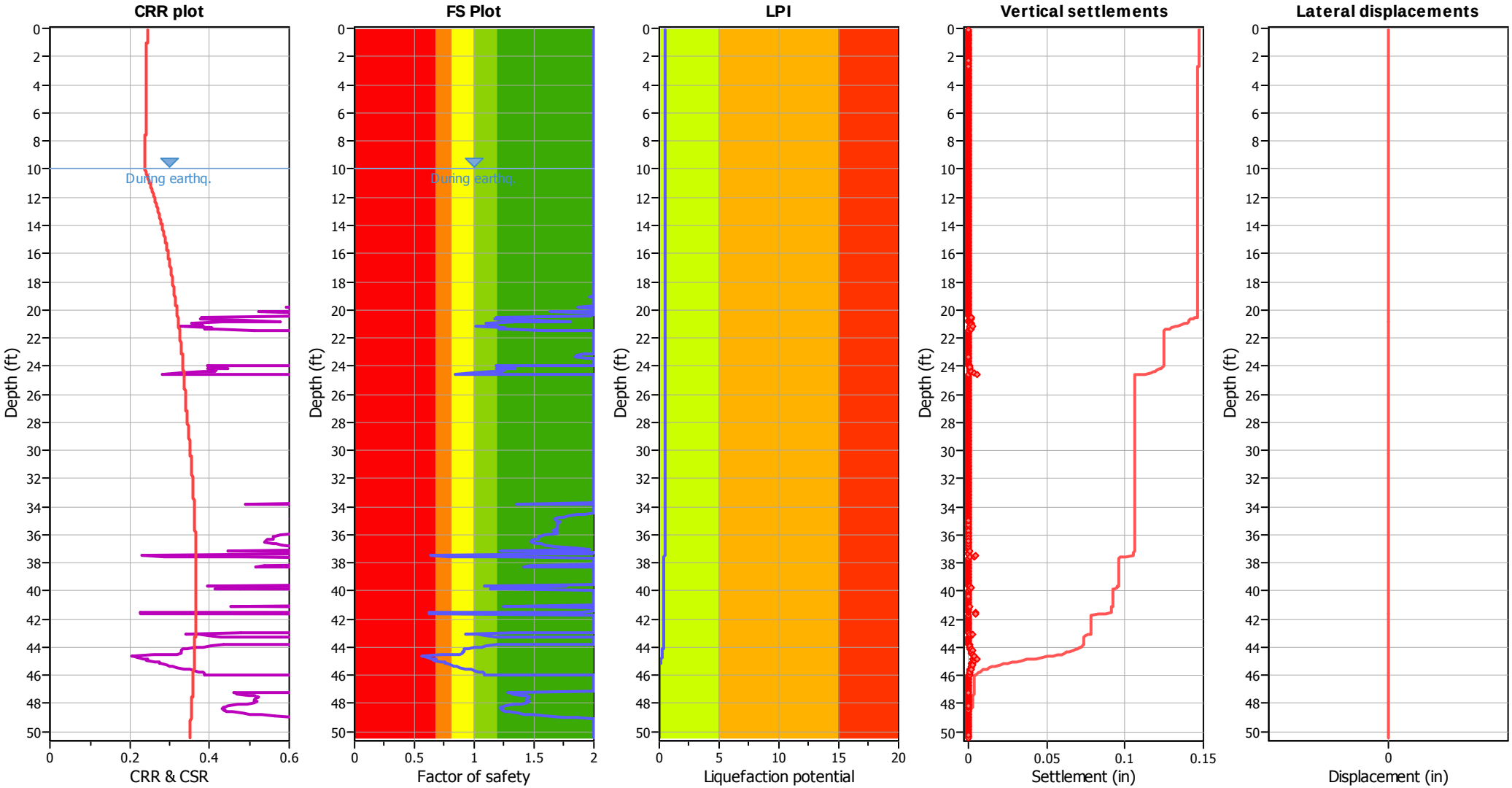
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.54	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.54	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

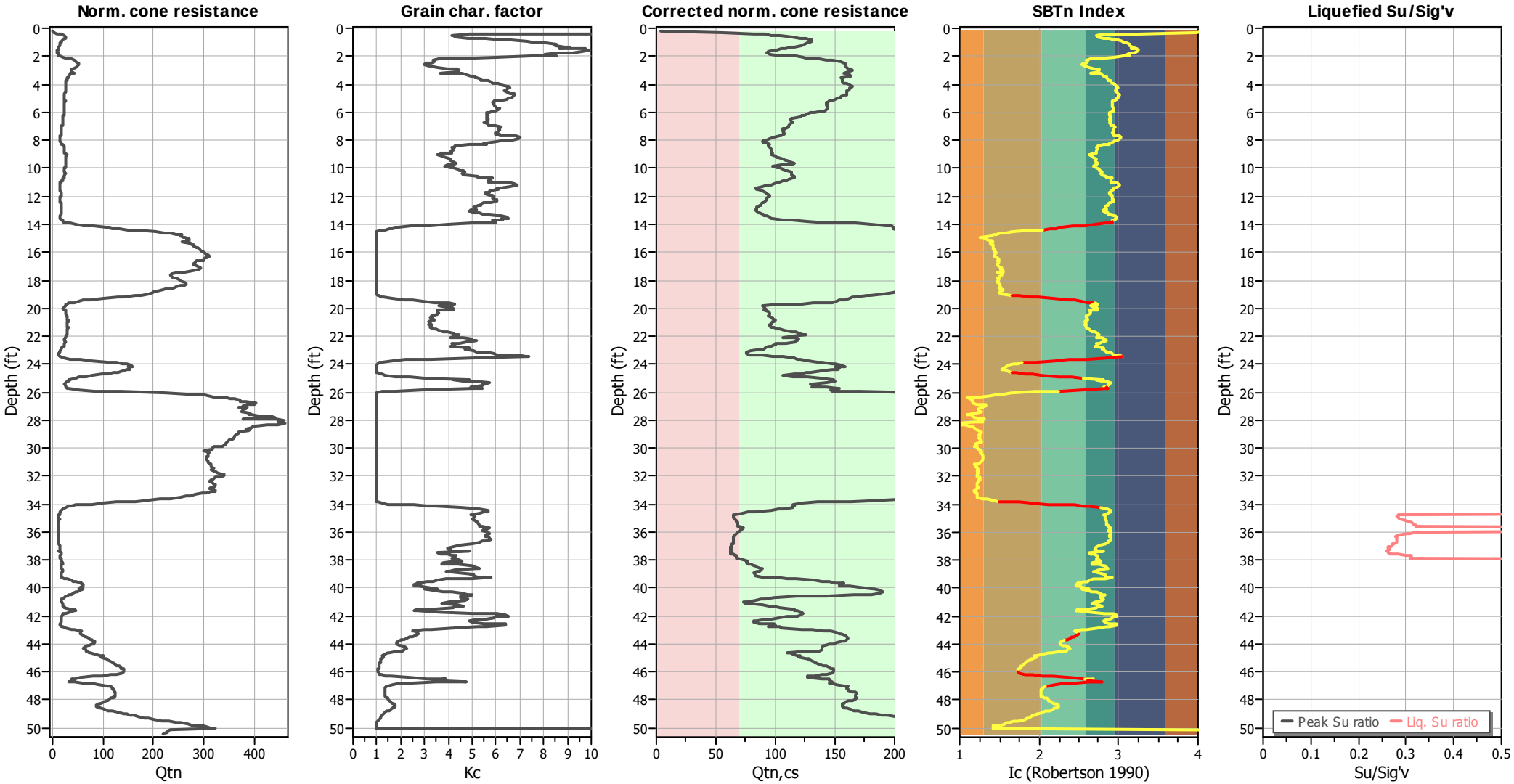
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.54	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

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23241 ARROYO VISTA
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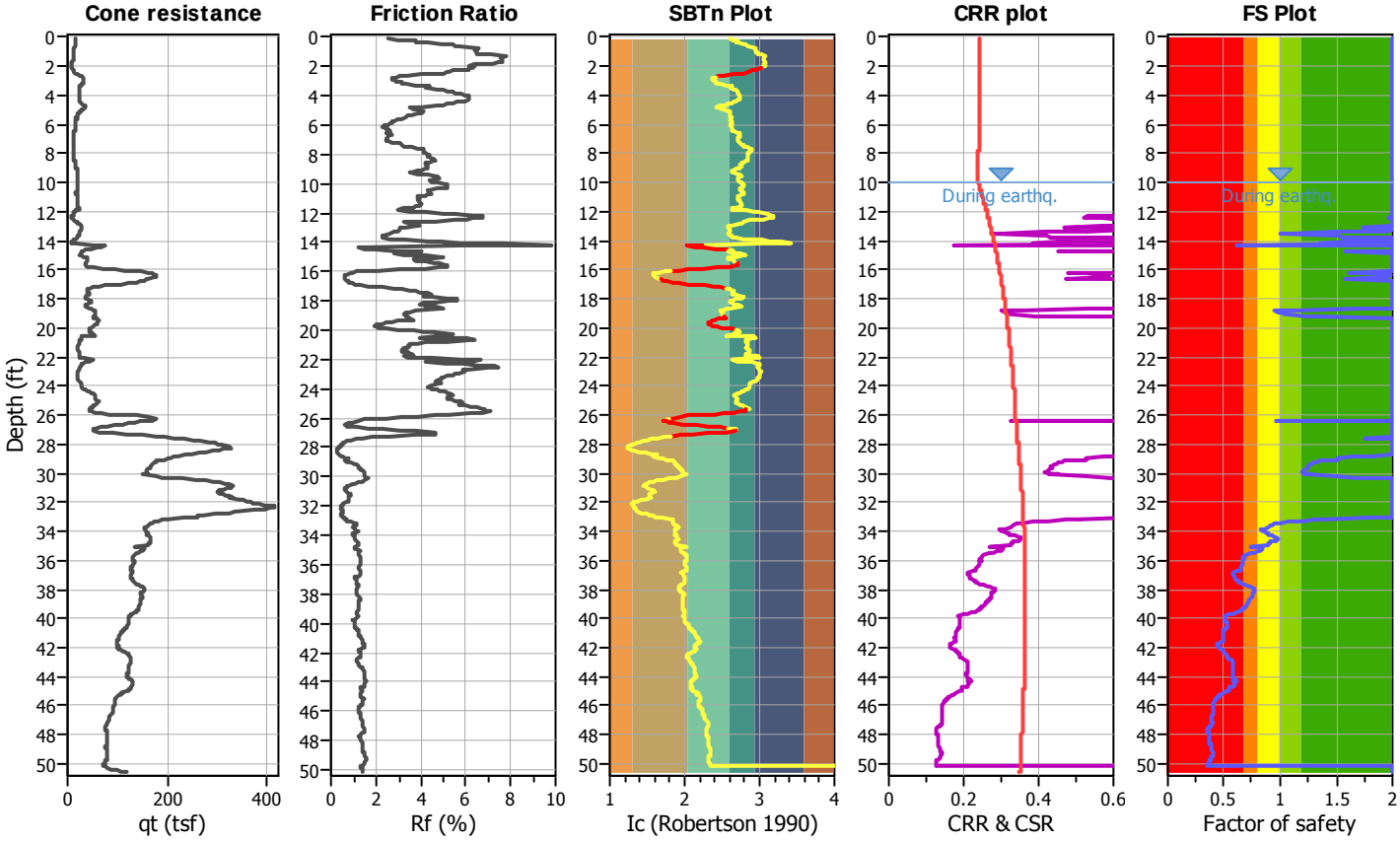
LIQUEFACTION ANALYSIS REPORT

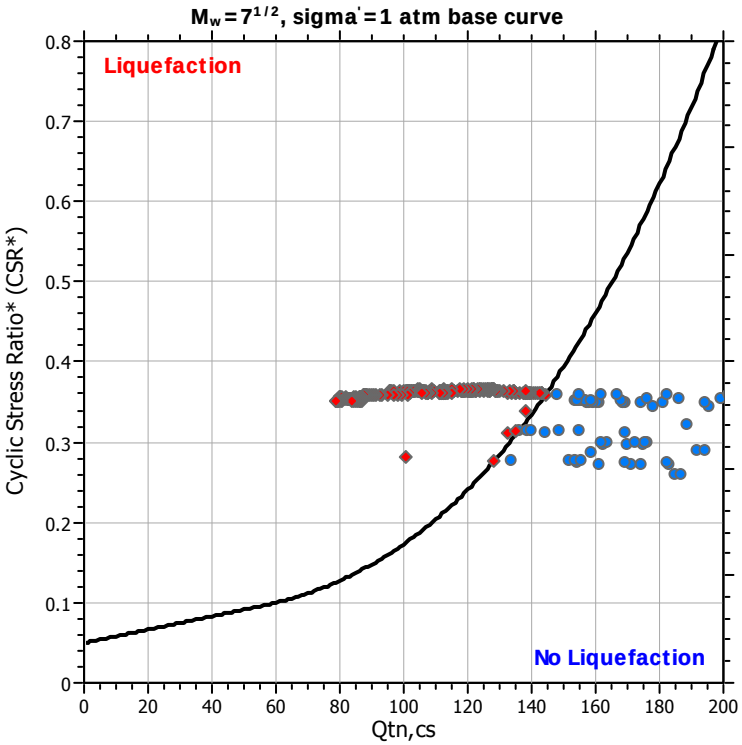
Project title : EF International Language Campus **Location : 3150 Bear St., Costa Mesa, CA**

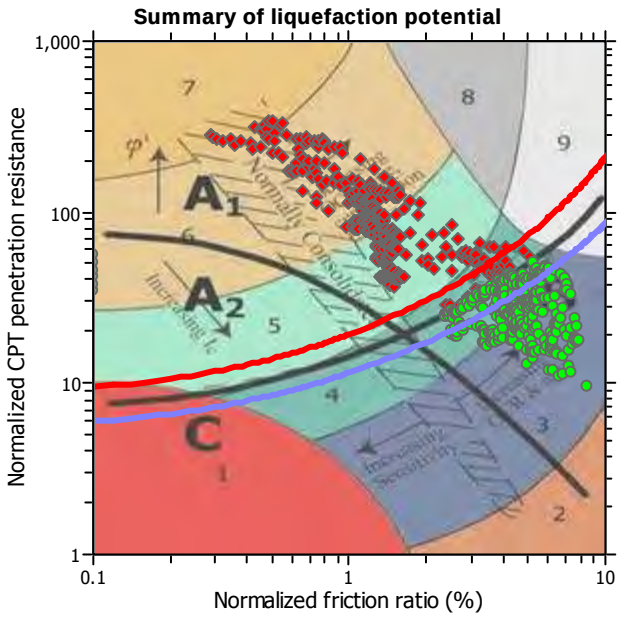
CPT file : CPT-2A

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	18.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.54	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

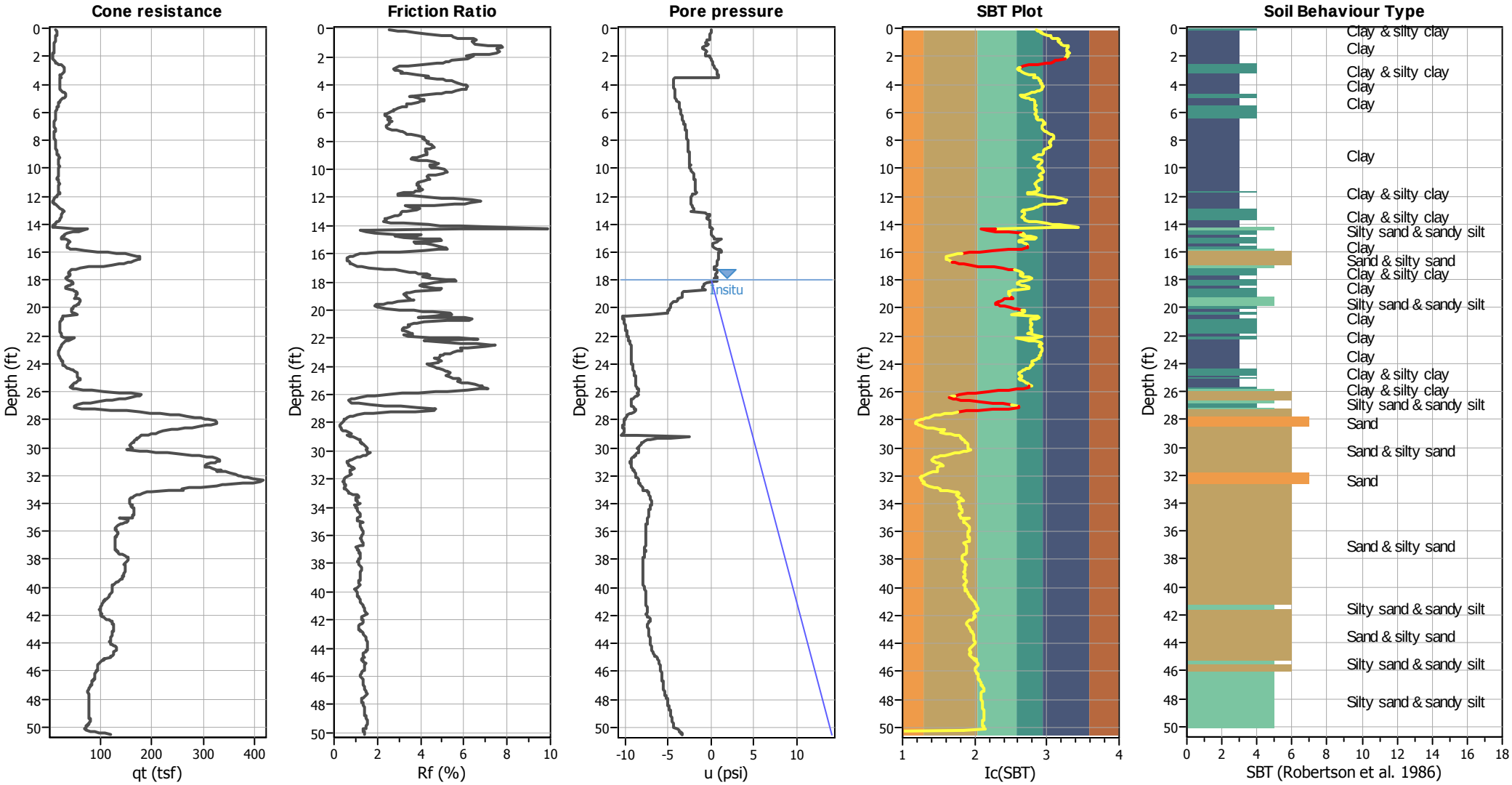






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



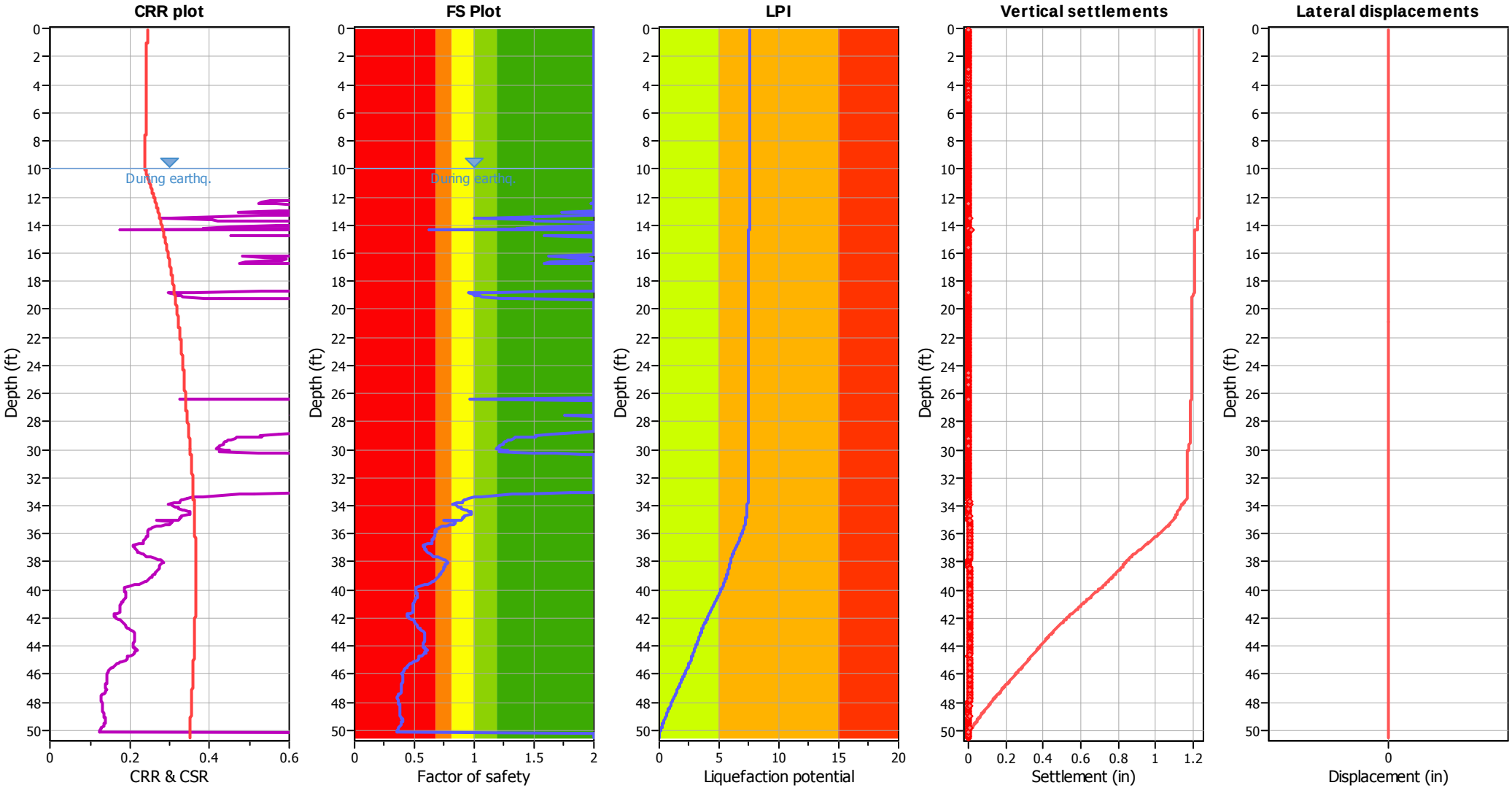
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.54	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.54	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

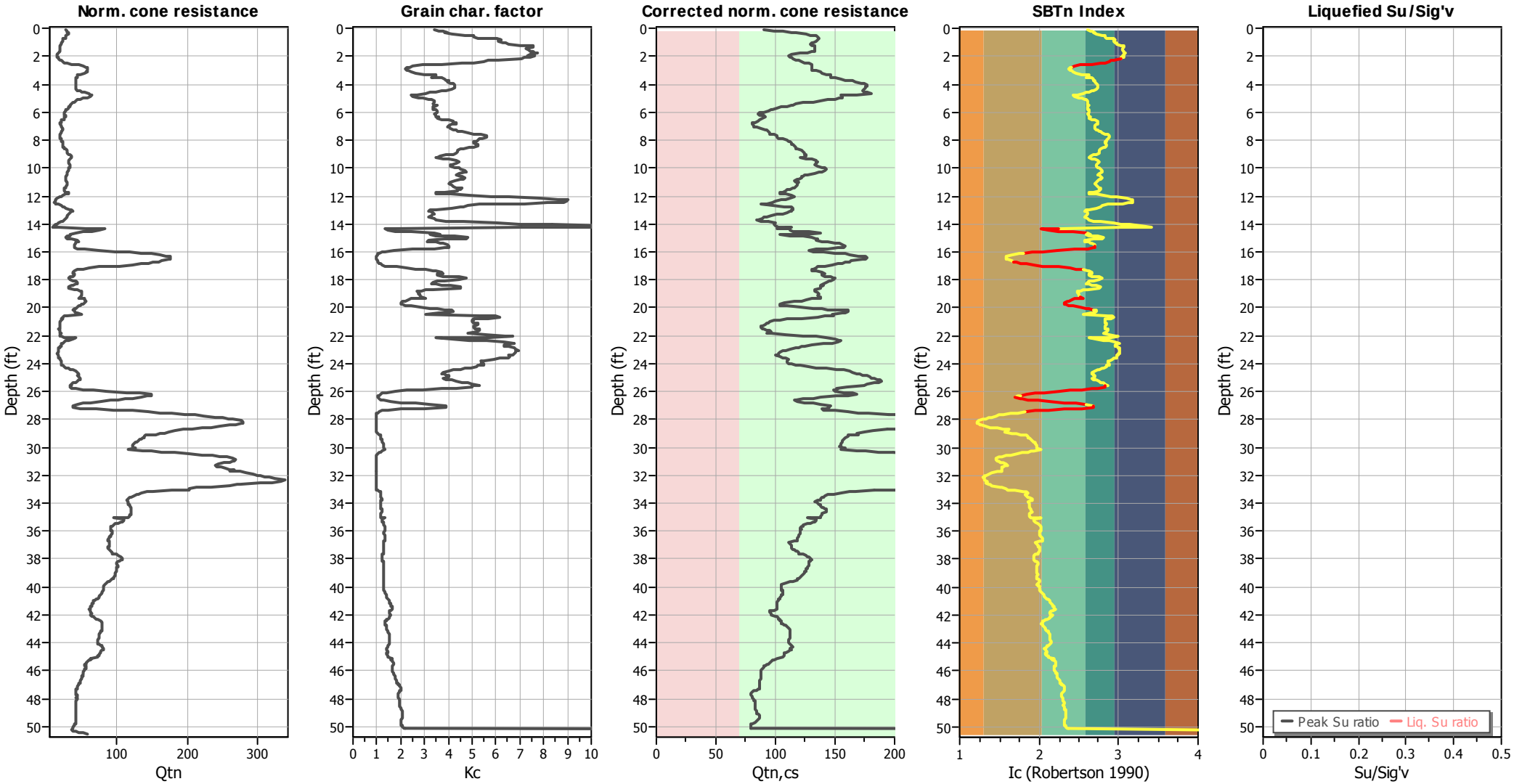
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.54	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

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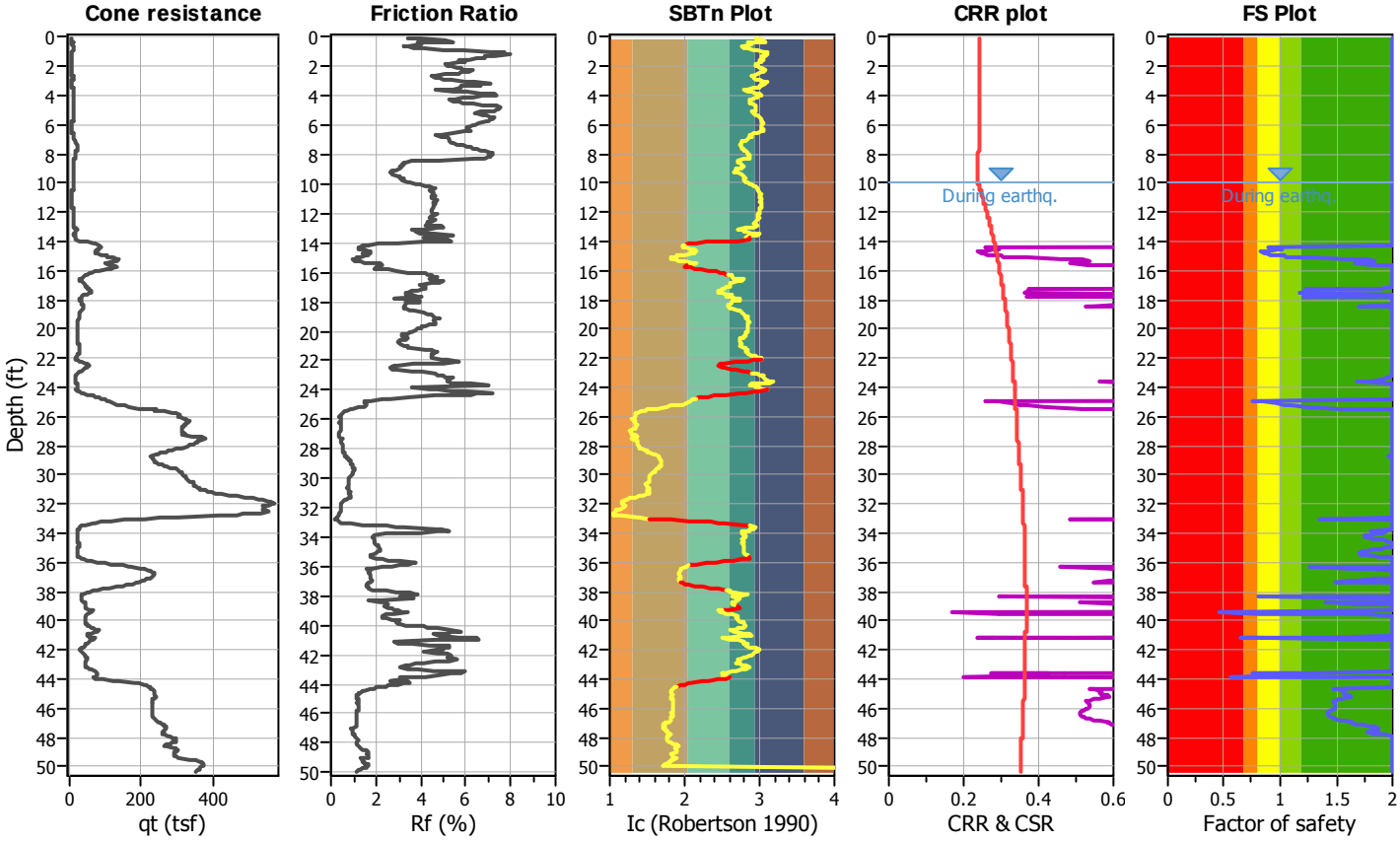
LIQUEFACTION ANALYSIS REPORT

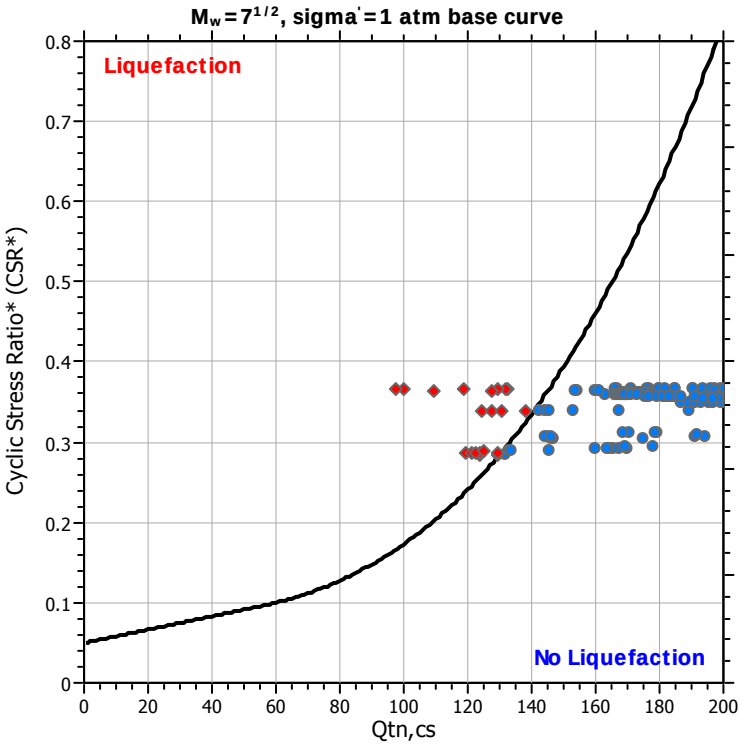
Project title : EF International Language Campus **Location : 3150 Bear St., Costa Mesa, CA**

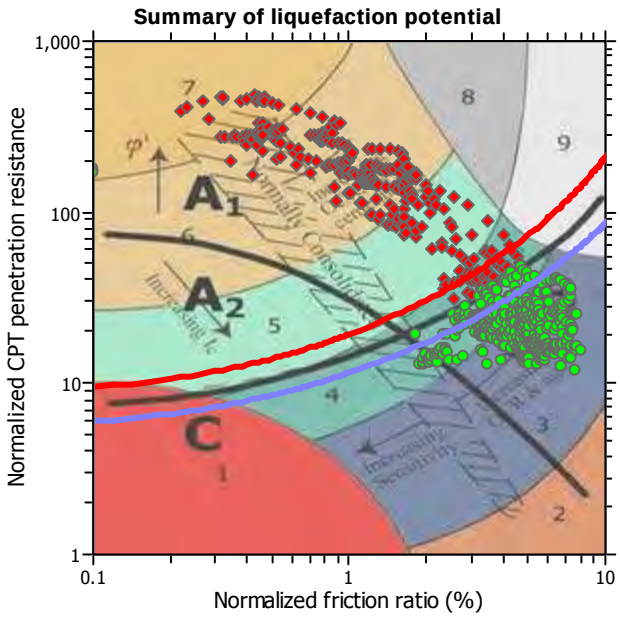
CPT file : CPT-3A

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	18.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.54	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

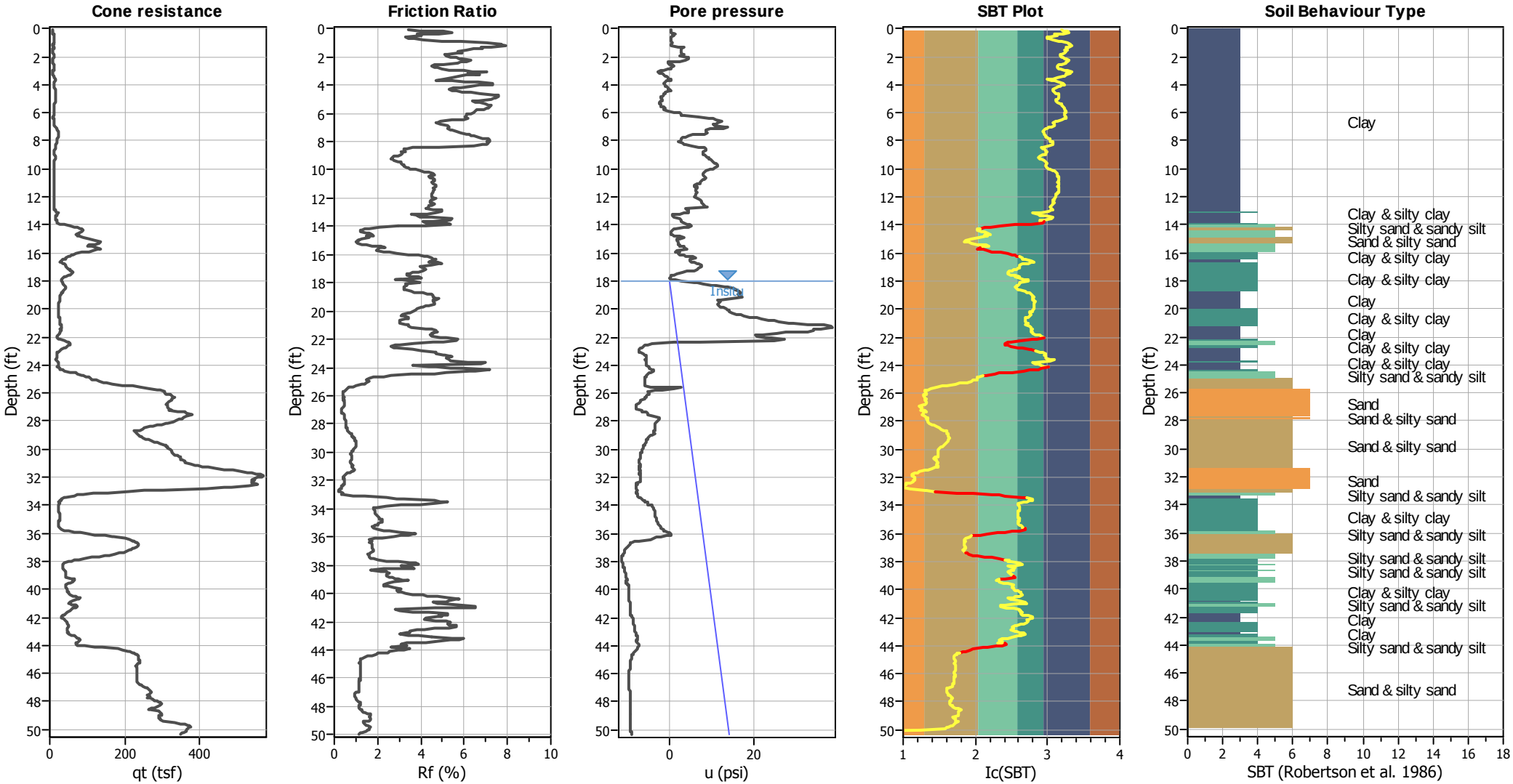






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



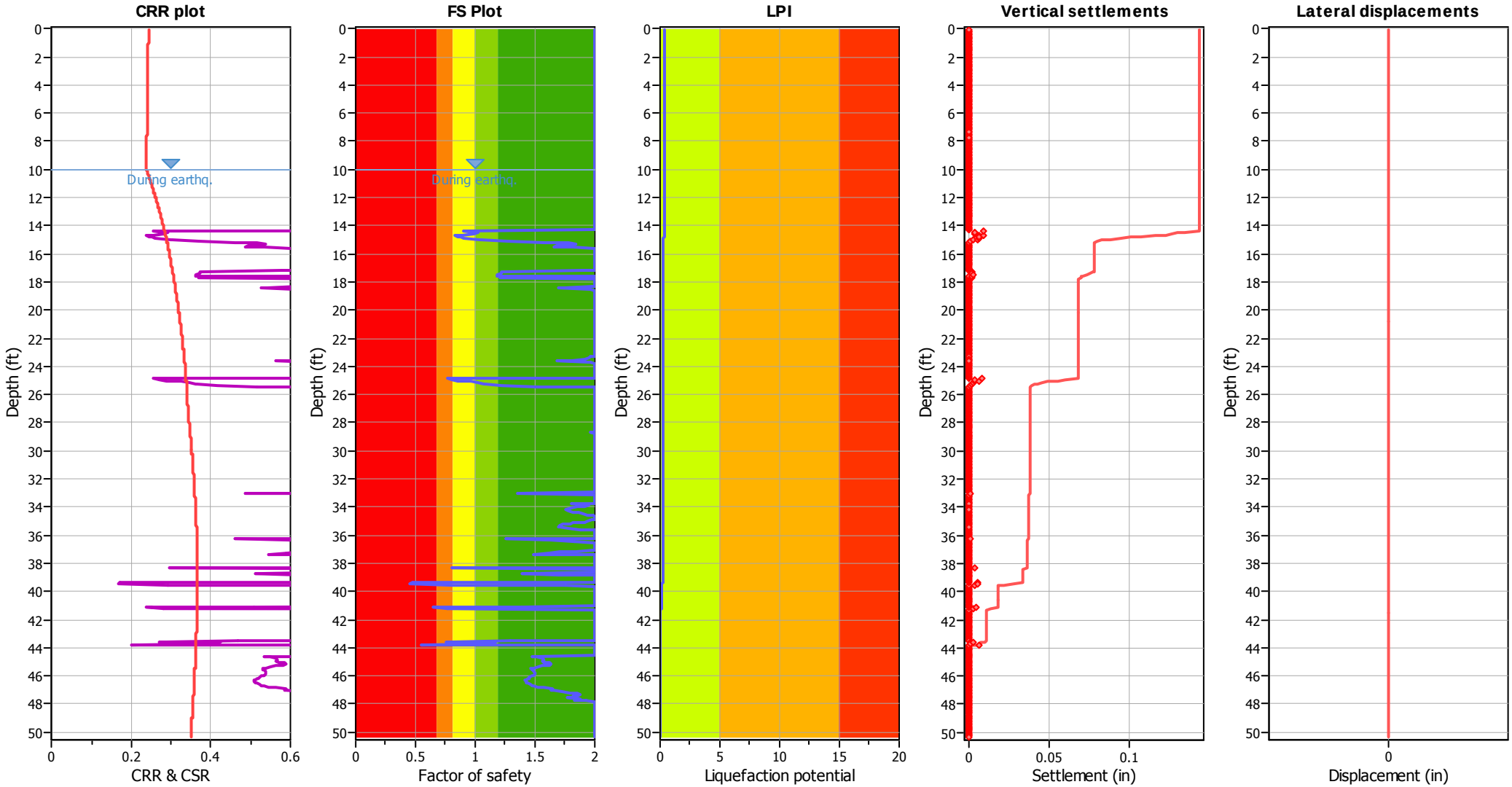
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.54	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.54	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

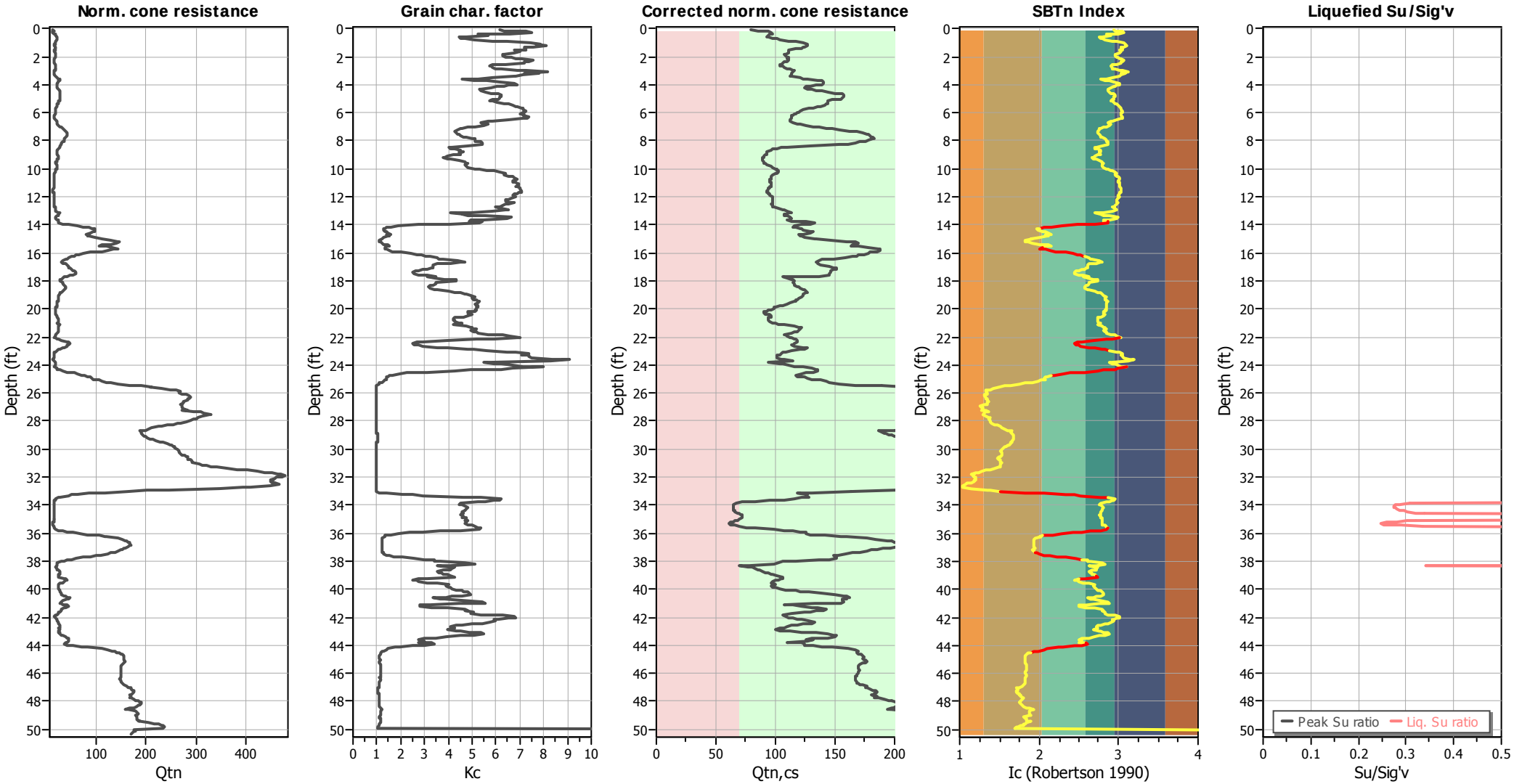
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.54	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

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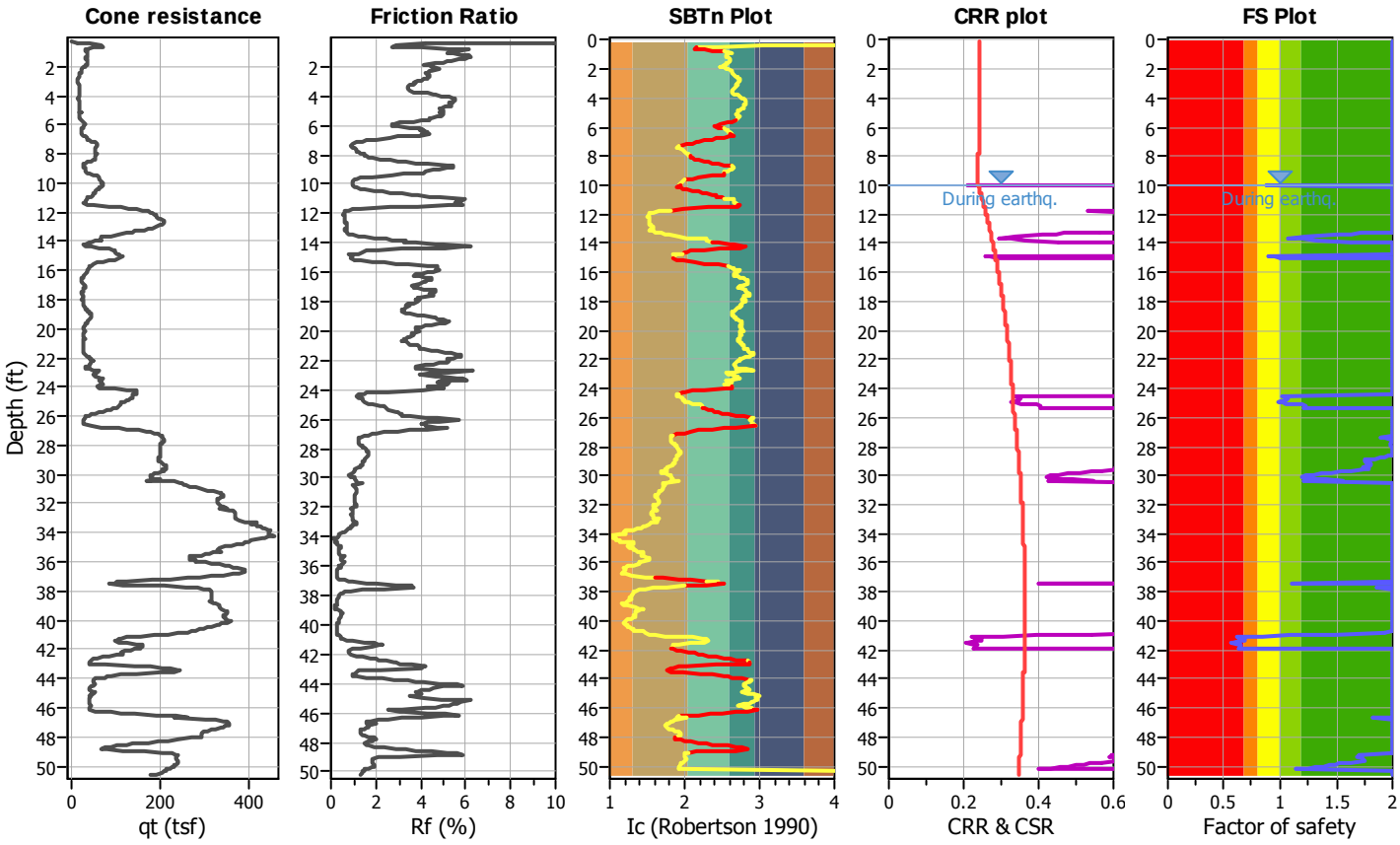
LIQUEFACTION ANALYSIS REPORT

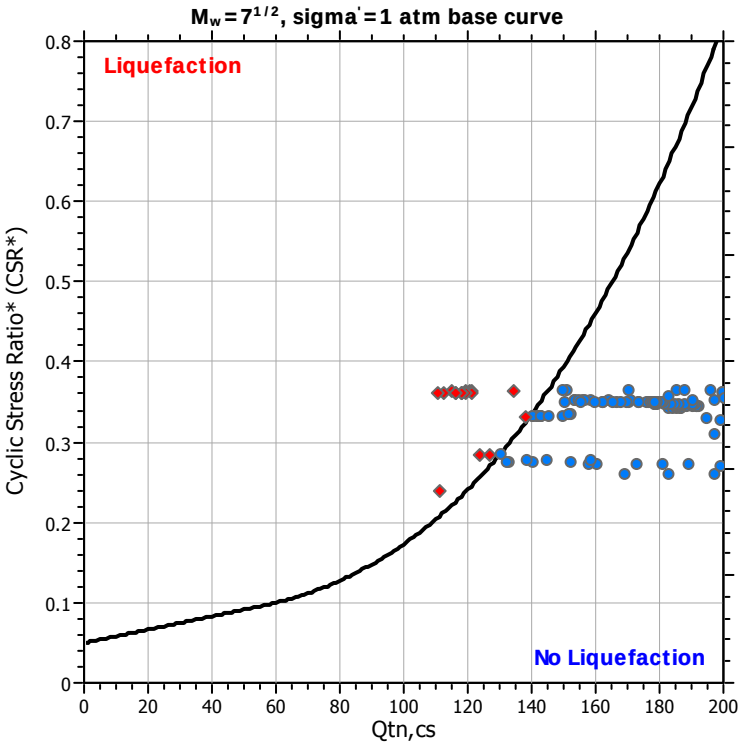
Project title : EF International Language Campus **Location : 3150 Bear St., Costa Mesa, CA**

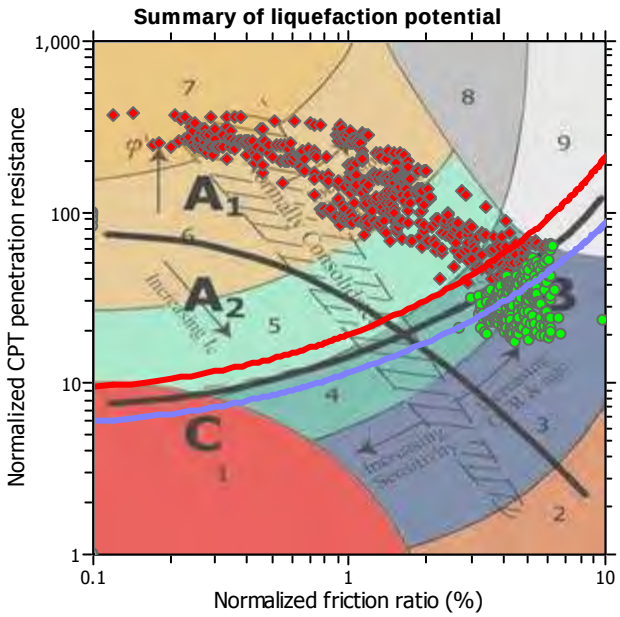
CPT file : CPT-4

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	18.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.54	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

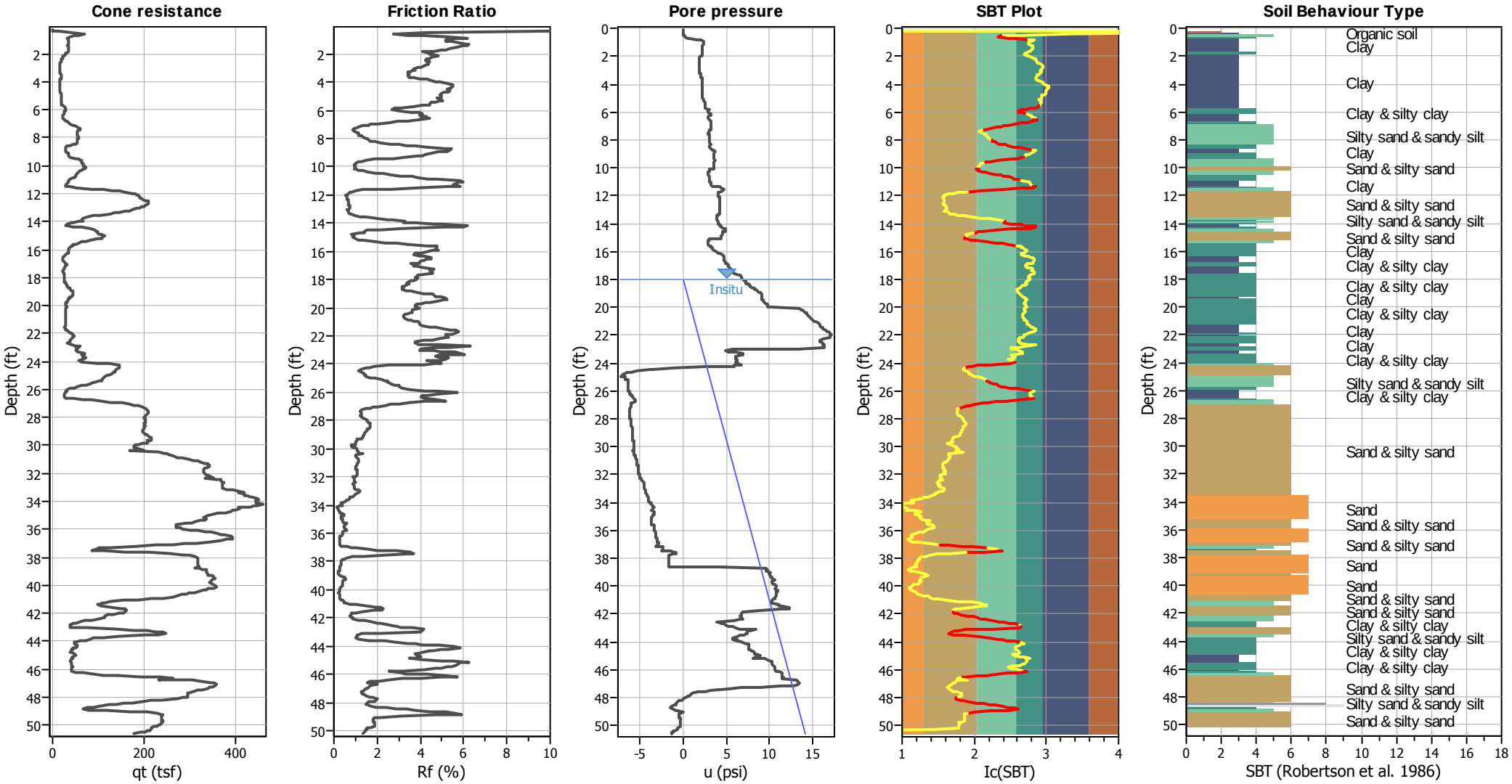






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



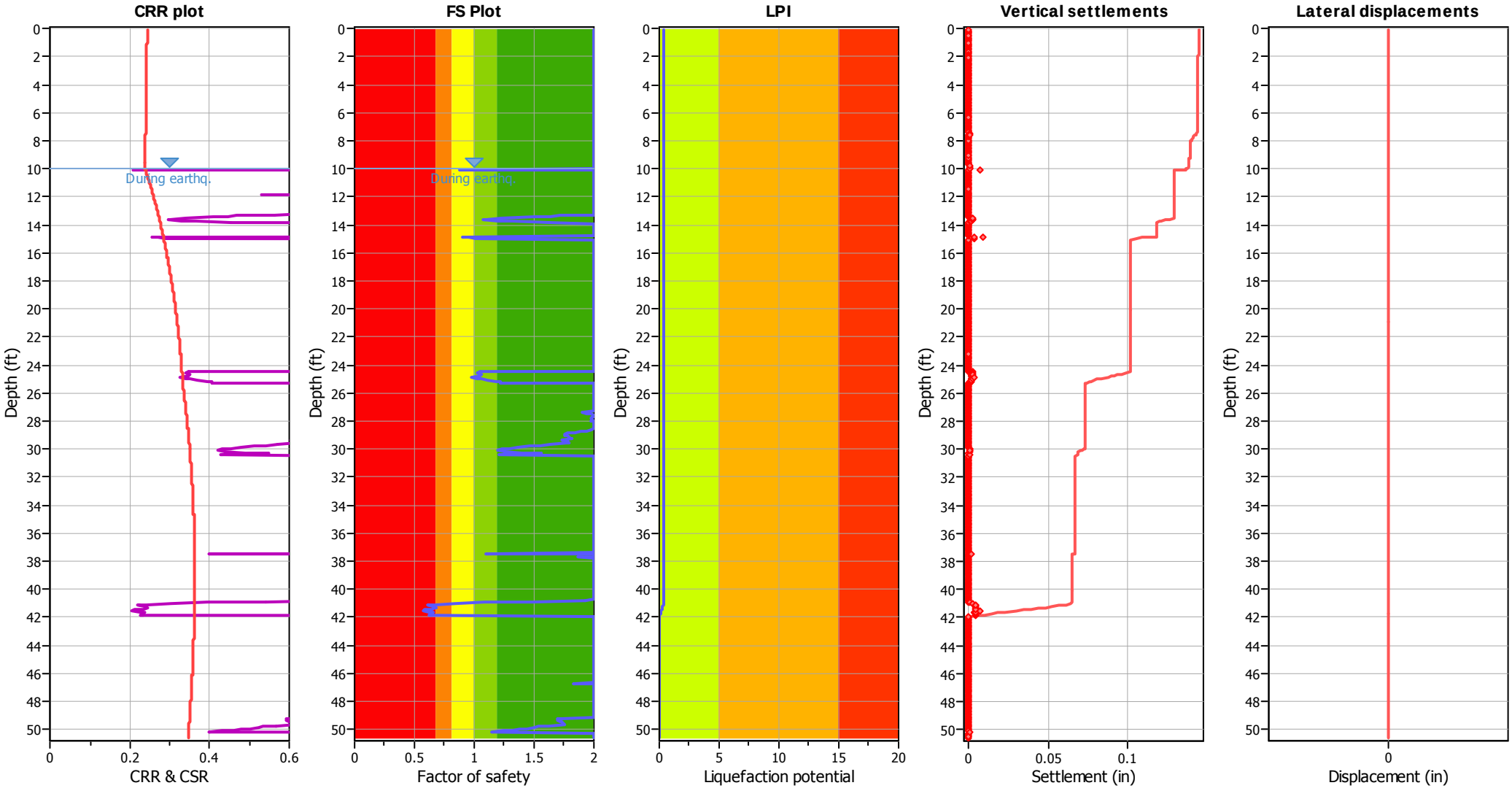
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.54	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.54	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
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LPI color scheme

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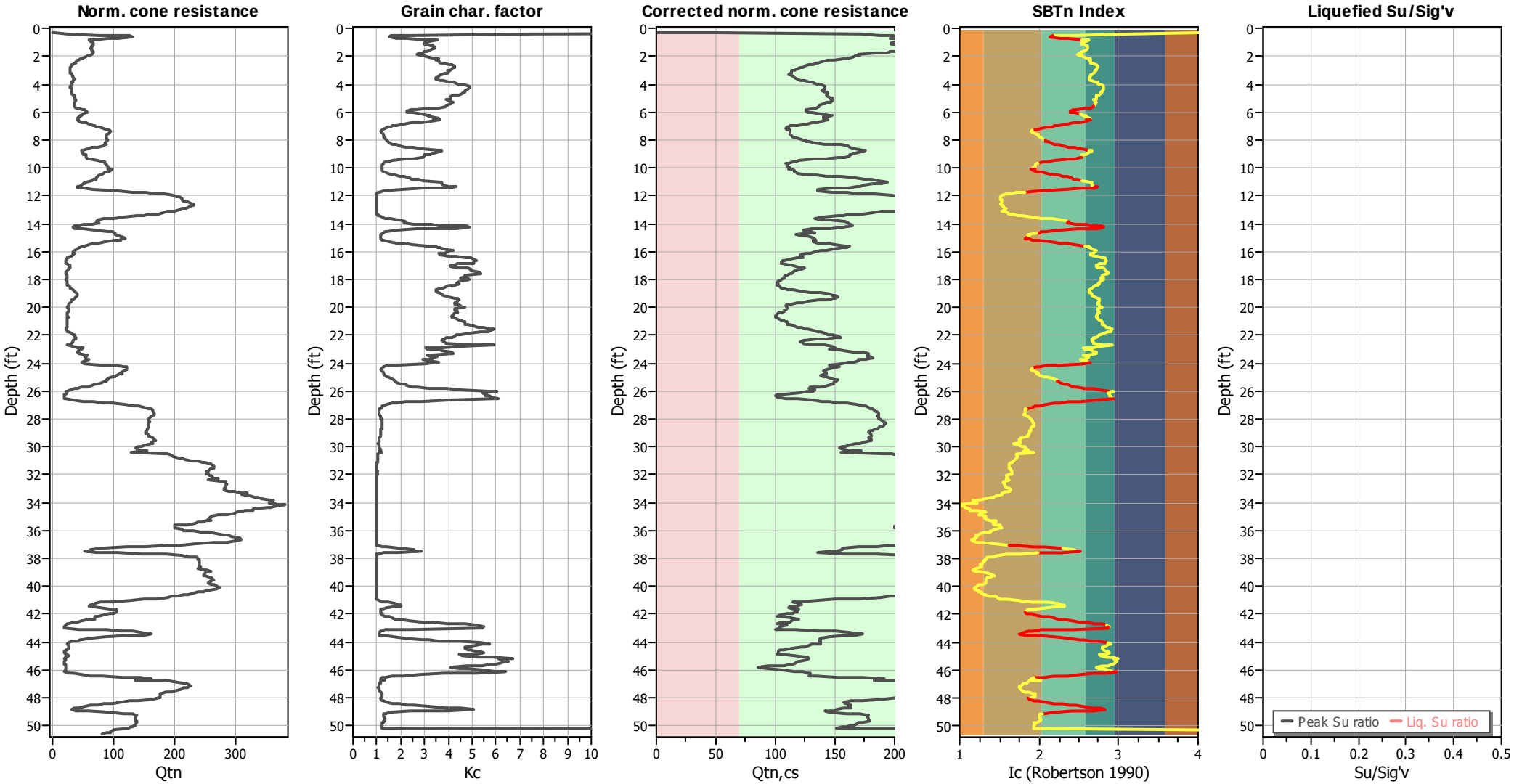
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	1	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.54	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

APPENDIX D

Percolation Test Result

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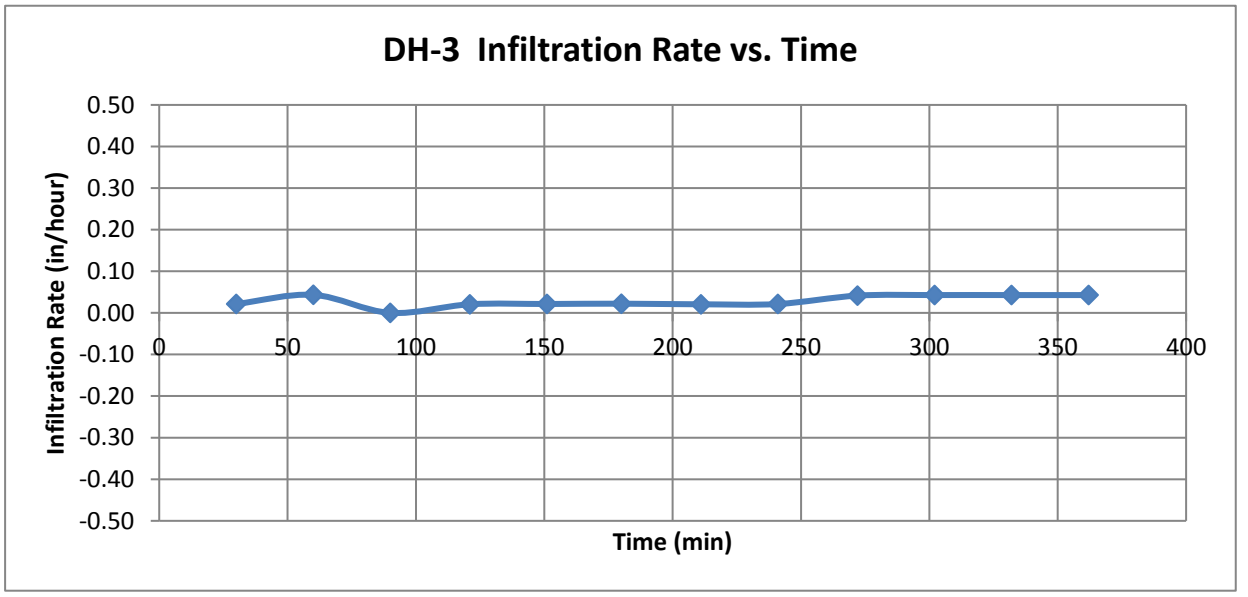
Riverside/Orange County - Infiltration Test in a Boring

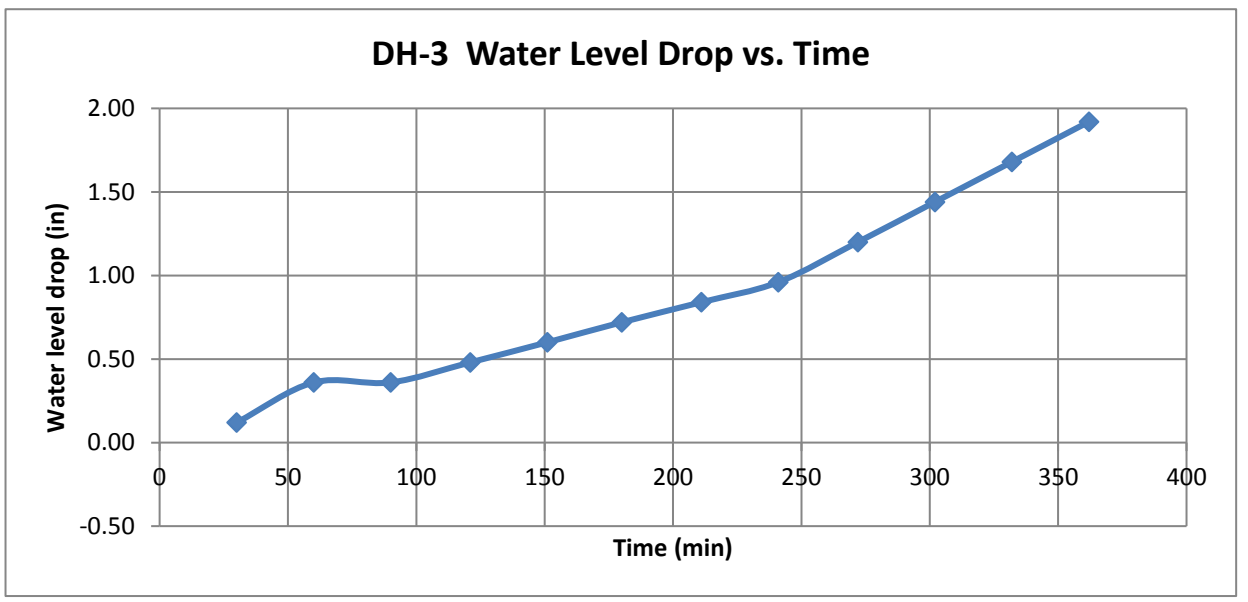
Project Name: EF International Language Campus
Project Number: 18-252-00

Test Hole Number: DH-3
Total Depth : 4.92 feet
Test Hole Diameter: 8.00 inches radius= 4 inches

Trial	Start Time	End Time	ΔT	Total Time	Initial Depth of Water	Final Depth of Water	ΔD	ΣΔD	ΔHavg	Infiltration Rate
			(min)	*(min)*	*(ft)*	*(ft)*	*(in)*	*(in)*	*(in)*	*(in/hour)*
1	7:55	8:25	30.0	30.0	3.22	3.23	0.12	0.12	20.34	0.02
2	8:25	8:55	30.0	60.0	3.23	3.25	0.24	0.36	20.16	0.04
3	8:55	9:25	30.0	90.0	3.21	3.21	0.00	0.36	20.52	0.00
4	9:25	9:56	31.0	121.0	3.21	3.22	0.12	0.48	20.46	0.02
5	9:56	10:26	30.0	151.0	3.21	3.22	0.12	0.60	20.46	0.02
6	10:26	10:55	29.0	180.0	3.21	3.22	0.12	0.72	20.46	0.02
7	10:55	11:26	31.0	211.0	3.21	3.22	0.12	0.84	20.46	0.02
8	11:26	11:56	30.0	241.0	3.21	3.22	0.12	0.96	20.46	0.02
9	11:56	12:27	31.0	272.0	3.21	3.23	0.24	1.20	20.40	0.04
10	12:27	12:57	30.0	302.0	3.21	3.23	0.24	1.44	20.4	0.04
11	12:57	13:27	30.0	332.0	3.21	3.23	0.24	1.68	20.4	0.04
12	13:27	13:57	30.0	362.0	3.21	3.23	0.24	1.92	20.4	0.04

Average Infiltration Rate (in/hour) 0.04





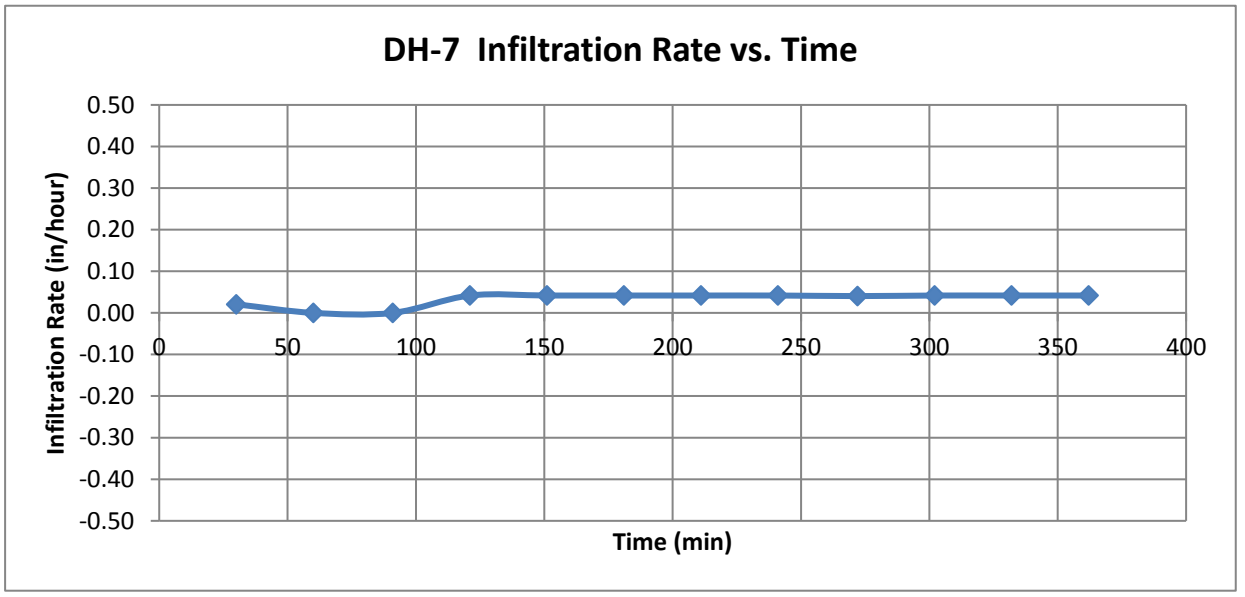
Riverside/Orange County - Infiltration Test in a Boring

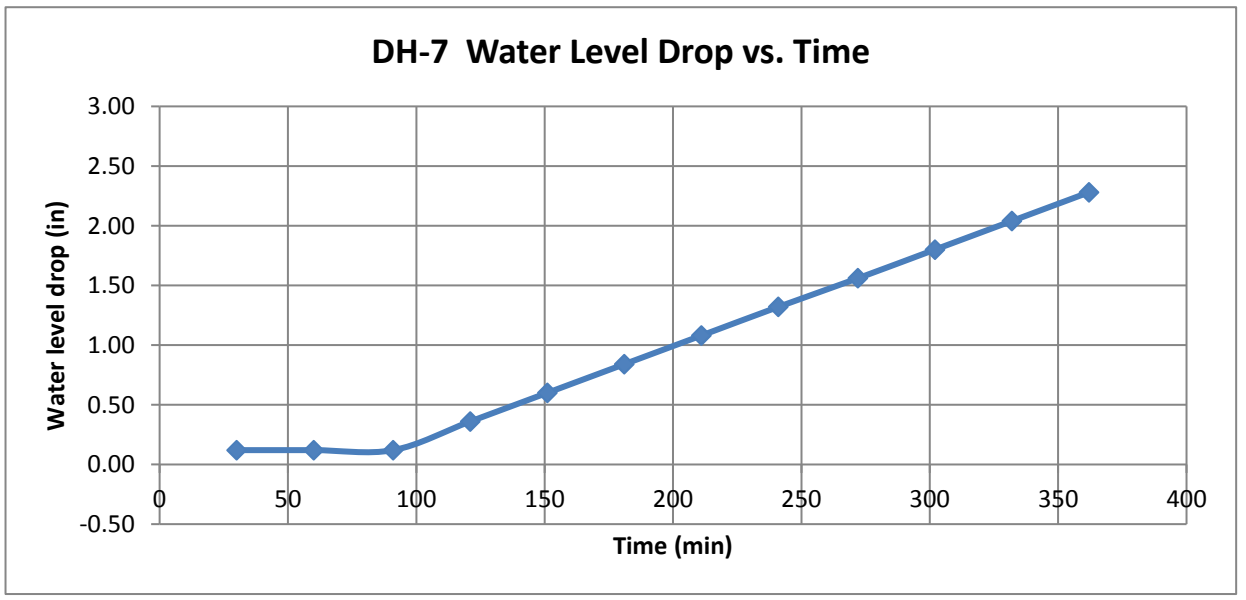
Project Name: EF International Language Campus
Project Number: 18-252-00

Test Hole Number: DH-7
Total Depth : 5.00 feet
Test Hole Diameter: 8.00 inches radius= 4 inches

Trial	Start Time	End Time	ΔT	Total Time	Initial Depth of Water	Final Depth of Water	ΔD	∑ΔD	ΔHavg	Infiltration Rate
			(min)	*(min)*	*(ft)*	*(ft)*	*(in)*	*(in)*	*(in)*	*(in/hour)*
1	8:02	8:32	30.0	30.0	3.23	3.24	0.12	0.12	21.18	0.02
2	8:32	9:02	30.0	60.0	3.24	3.24	0.00	0.12	21.12	0.00
3	9:02	9:33	31.0	91.0	3.24	3.24	0.00	0.12	21.12	0.00
4	9:33	10:03	30.0	121.0	3.24	3.26	0.24	0.36	21.00	0.04
5	10:03	10:33	30.0	151.0	3.24	3.26	0.24	0.60	21.00	0.04
6	10:33	11:03	30.0	181.0	3.24	3.26	0.24	0.84	21.00	0.04
7	11:03	11:33	30.0	211.0	3.24	3.26	0.24	1.08	21.00	0.04
8	11:33	12:03	30.0	241.0	3.24	3.26	0.24	1.32	21.00	0.04
9	12:03	12:34	31.0	272.0	3.24	3.26	0.24	1.56	21.00	0.04
10	12:34	13:04	30.0	302.0	3.24	3.26	0.24	1.80	21	0.04
11	13:04	13:34	30.0	332.0	3.24	3.26	0.24	2.04	21	0.04
12	13:34	14:04	30.0	362.0	3.24	3.26	0.24	2.28	21	0.04

Average Infiltration Rate (in/hour) 0.04

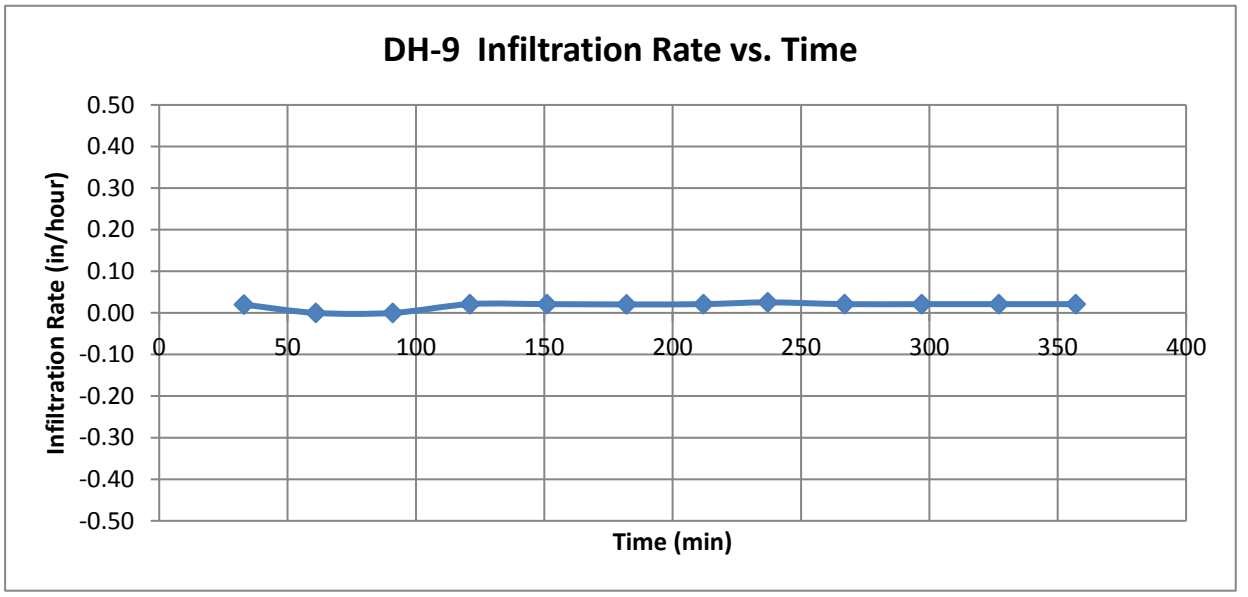
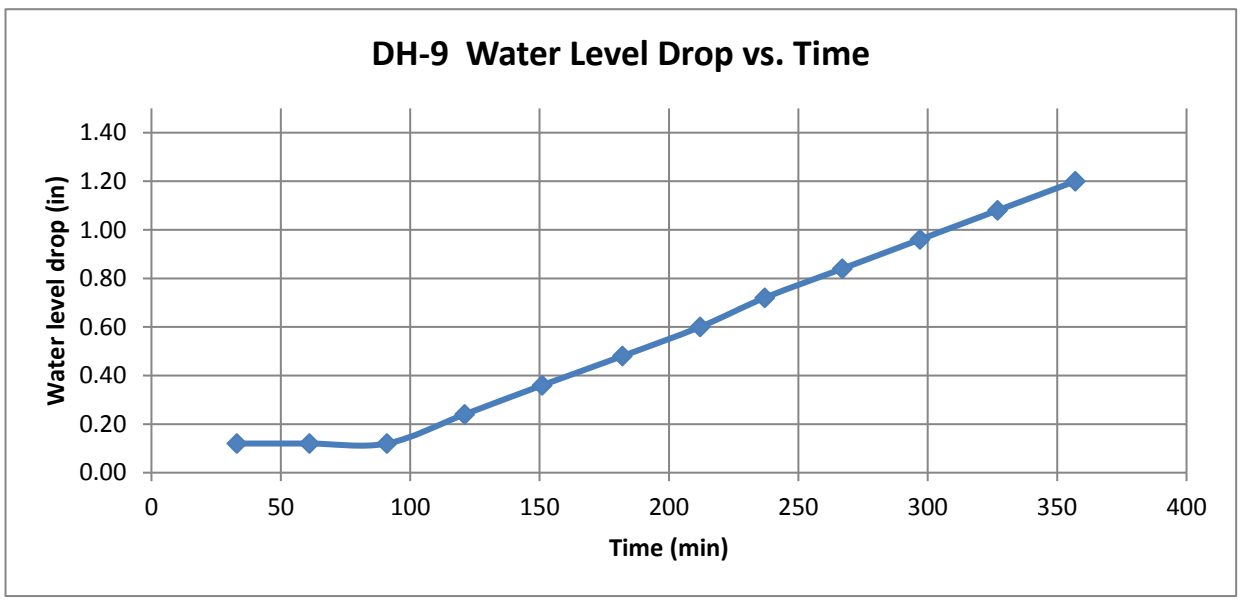




Riverside/Orange County - Infiltration Test in a Boring

Project Name: EF International Language Campus
Project Number: 18-252-00

Test Hole Number: DH-9
Total Depth : 5.00 feet
Test Hole Diameter: 8.00 inches radius= 4 inches

Trial	Start Time	End Time	ΔT	Total Time	Initial Depth of Water	Final Depth of Water	ΔD	∑ΔD	ΔHavg	Infiltration Rate
			(min)	*(min)*	*(ft)*	*(ft)*	*(in)*	*(in)*	*(in)*	*(in/hour)*
1	8:10	8:43	33.0	33.0	3.33	3.34	0.12	0.12	19.98	0.02
2	8:43	9:11	28.0	61.0	3.28	3.28	0.00	0.12	20.64	0.00
3	9:11	9:41	30.0	91.0	3.28	3.28	0.00	0.12	20.64	0.00
4	9:41	10:11	30.0	121.0	3.26	3.27	0.12	0.24	20.82	0.02
5	10:11	10:41	30.0	151.0	3.26	3.27	0.12	0.36	20.82	0.02
6	10:41	11:12	31.0	182.0	3.26	3.27	0.12	0.48	20.82	0.02
7	11:12	11:42	30.0	212.0	3.26	3.27	0.12	0.60	20.82	0.02
8	11:42	12:07	25.0	237.0	3.26	3.27	0.12	0.72	20.82	0.03
9	12:07	12:37	30.0	267.0	3.26	3.27	0.12	0.84	20.82	0.02
10	12:37	13:07	30.0	297.0	3.26	3.27	0.12	0.96	20.82	0.02
11	13:07	13:37	30.0	327.0	3.26	3.27	0.12	1.08	20.82	0.02
12	13:37	14:07	30.0	357.0	3.26	3.27	0.12	1.20	20.82	0.02

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