APPENDIX F

PRELIMINARY WATER QUALITY MANAGEMENT PLAN

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Preliminary Water Quality Management Plan (WQMP)

Project Name:

Citrus Square – Senior Community, TTM 19147

9470 Moody Street, Cypress, CA 90630

Prepared for:

Melia Homes

8951 Research Drive, Suite 100

Irvine, CA 92618

(949) 759-4367

Prepared by:

C&V Consulting, Inc.

Engineer: Dane McDougall Registration No.: 80705

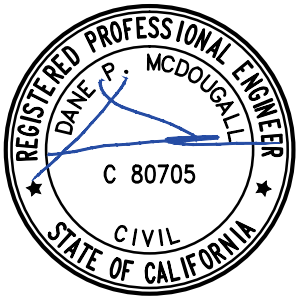
9830 Irvine Center Drive

Irvine, CA 92618

(949) 916-3800

City Planner (Checked for site plan consistency only)	Date
Water Quality Manager	Date
Reviewing Engineer	Date
City Engineer	Date

Date Prepared: March 9, 2021
Revised: May 24, 2021



Project Owner's Certification			
Permit/Application No.	TBD	Grading Permit No.	TBD
Tract/Parcel Map No.	TTM 19147	Building Permit No.	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract)			244-092-30

This Preliminary Water Quality Management Plan (WQMP) has been prepared for Melia Homes by C&V Consulting Inc. The Preliminary WQMP is intended to comply with the requirements of the local NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the 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: Chad Brown			
Title	Vice President of Planning & Development		
Company	Melia Homes		
Address	2951 Research Drive, Suite 100, Irvine, CA 92618		
Email	chad@melia-homes.com		
Telephone #	(949) 759-4367		
Signature		Date	

Project Engineer's Certification			
Permit/Application No.	TBD	Grading Permit No.	TBD
Tract/Parcel Map No.	TTM 19147	Building Permit No.	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract)			244-092-30

I, Dane McDougall, P.E. certify that this Preliminary Water Quality Management Plan (WQMP) has been prepared under my responsible charge and as the engineer of record, I have read and understood the requirements of the Regional Board Order R8-2009-0030, Section XII-B, the 2003 and 2007 Drainage Area Management Plan (DAMP), the City of Cypress Local Implementation Plan (LIP), Section 13-23 of the City of Cypress Municipal Code, and prepared this WQMP in compliance with all requirements thereto.

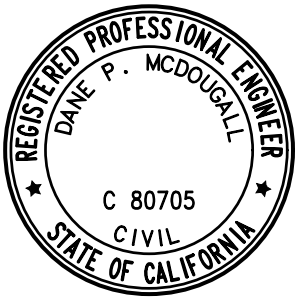
Furthermore, I attest that the WQMP for the development includes, but is not limited to the following:

1) Prioritization of the use of Low Impact Development principles as follows:
   a. Preserves natural features;
   b. Minimizes runoff and reduces impervious surfaces;
   c. Utilizes infiltration of runoff as the method of pollutant treatment.
2) Incorporation of the applicable Routine Source and Structural Control BMPs as defined in the Drainage Area Management Plan (DAMP).
3) Matching time of concentration, runoff, velocity, volume, and hydrograph for a 2-year storm event, providing no increase in downstream erosion and avoids downstream impacts to physical structures, aquatic, and riparian habitat.
4) Using alternative treatment controls (in lieu of standard) that meet the requirements of section 7.6.5 of the DAMP and are equally or more effective in pollutant reduction than comparable BMPs.

Additionally, this WQMP contains information that:

1) Describes the long-term operation and maintenance requirements for structural and Treatment Control BMPs.
2) Identifies the entity or employees that will be responsible for long-term operation, maintenance, repair and or replacement of the structural and Treatment Control BMPs, and the training that qualifies such entity or employees to operate and maintain the BMPs.
3) Describes the recordkeeping requirements and contains a copy of the forms to be used in conducting maintenance and inspection activities.
4) Describes the mechanism for funding the long-term operation and maintenance of all structural and Treatment Control BMPs.

Engineer:			
Name	Dane McDougall, P.E.		
Company	C&V Consulting, Inc.		
Email	dmcdougall@cvc-inc.net		
Telephone #	(949) 916-3800		
Signature		Date	6/3/2021



Registered Engineer's Seal

Contents

Page No.

Attachments

Section I Discretionary Permit(s) and Water Quality Conditions

Project Infomation			
Permit/Application No.	TBD	Tract/Parcel Map No.	TTM 19147
Additional Information/ Comments:	9470 Moody Street, Cypress, CA 90630 TTM 19147, Lots 1-3		
Water Quality Conditions			
Water Quality Conditions (list verbatim)	Conditions of Approval have not been issued at this time. Water Quality Conditions of Approval will be provided within the Final WQMP.		
Watershed-Based Plan Conditions			
Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	San Gabriel-Coyote-Creek Watershed does not have any approved WHIMPs, however the Coyote-Creek Channel has USEPA approved TMDLs for Dissolved Copper, Indicator Bacteria and Lead.		

Section II Project Description

II.1 Project Description

Description of Proposed Project		
Development Category (Verbatim from WQMP):	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): 276,069	Number of Dwelling Units: 98	SIC Code: n/a
Narrative Project Description:	The proposed 6.34 acre site is currently occupied the Cypress School District with approximately seven (7) existing buildings, including various additional module/ storage structures. The existing site has approximately 47% (129,884 square feet (sf)) pervious coverage, consisting of vacant, undeveloped area and typically commercial landscaping. Perimeter walls exist along the north and east property lines of the site. The existing site is bounded by existing single family residential to the north, an existing church to the east, Orange Avenue, and existing single family to the south and Moody Street and existing commercial and single family residential to the west. The proposed residential development will consist of ten (10) 2-story, multi-family residential buildings which will consist of 48 townhome units and 50 affordable housing apartment units. Units will consist of 1-, 2- and 3-bedroom layouts and will range in between 767 to 2,022 square feet. Associated parking areas will consist of 96 private garages, 73 private open stalls, and 50 carport spaces. In addition, the residential development will include a private drive aisle, recreational areas, sidewalks, landscaped open-space areas and recreational pool/ spa area. The drive aisle will be asphalt concrete pavement and sidewalks will be Portland cement concrete (PCC). Landscaped areas are assumed to amount to approximately 15% pervious coverage. During final engineering, actual project perviousness will be calculated.	

<table>
<tr><td></td><td colspan="4">Best Management Practice (BMP) selection for treatment of stormwater has been described in Section IV of this report. Implementation of BMPs will address the pollutants of concern associated with multi-family residential development. No car washing, outdoor storage or food processing areas will be incorporated on this project.

The project will be serviced by onsite private water system and onsite private sanitary sewer system that will be maintained by a homeowner's association and/ or appointed property management company. The proposed private water system will have two points of connection to the existing City maintained public water mains within Moody Street and Orange Avenue. The proposed private onsite sanitary sewer system will be gravity fed from one point of connection to the existing City maintained public sewer main within Orange Avenue.

Long-term maintenance is planned to be handled by a Homeowner's Association (HOA) and/ or Property Management Company (PMC) appointed by Melia Homes.

Refer to Attachment A of this report for a copy of the Preliminary WQMP Exhibit.</td></tr>
<tr><td rowspan="2">Project Area</td><td colspan="2">Pervious</td><td colspan="2">Impervious</td></tr>
<tr><td>Area
(acres or sq ft)</td><td>Percentage</td><td>Area
(acres or sq ft)</td><td>Percentage</td></tr>
<tr><td>Pre-Project Conditions</td><td>2.98 ac
(129,884 sf)</td><td>49%</td><td>3.36 ac
(146,185 sf)</td><td>51%</td></tr>
<tr><td>Post-Project Conditions *</td><td>0.95 ac
(41,410 sf)</td><td>15%</td><td>5.39 ac
(234,659 sf)</td><td>85%</td></tr>
<tr><td>Drainage Patterns/Connections</td><td colspan="4">The proposed development will be divided into three (3) lots. Lot 1 will be developed as traditional market rate townhomes, Lot 2 will be developed as affordable housing for senior living and Lot 3 will consist of the recreational area which will be shared between Lots 1 and 2. The entire site will be developed as part of this project and the Preliminary WQMP has been prepared as such.

The westerly half of the existing site drains towards Moody Street to the west, with some portions of the existing parking lot draining to the south towards Orange Avenue. The easterly half of the existing site drains to the south towards Orange Avenue. Existing drainage is conveyed vis surface runoff overland. There are no visible existing storm drain facilities located onsite. An existing public City of Cypress 42" reinforced concrete pipe storm drain system</td></tr>
</table>

	is located within Orange Avenue, flowing in the westerly direction. An existing catch basin is located near the northeast corner of Orange Avenue at Moody Street that connects to the existing storm drain system within Orange Avenue. Stormwater runoff that enters the existing storm drain system within Orange Avenue continues flowing in the westerly direction, where converging with the Lincoln Storm Drain (OCFCD Facility No. B00P01) and Carbon Creek Channel (OCFCD Facility No. B01), then the Coyote Creek and San Gabriel River, ultimately to the discharging to the Pacific Ocean. Refer to Attachment B of this report for a copy of the OCFCD Drainage Facilities Maps. The proposed residential development will be divided into seven (7) Drainage Management Areas (DMA) developed based on the proposed grading design. The proposed drainage system will collect and convey stormwater runoff to the proposed biofiltration systems for water quality treatment via proposed underground storm drain and area drain piping. The proposed biofiltration systems will be equipped with internal bypass and upstream diversion systems within the proposed catch basins. The proposed private underground storm drain has been designed discharge treated and overflow stormwater runoff to two (2) proposed public points of connections to the existing City public 42" storm drain within Orange Avenue. Onsite localized sumps have been designed to collect and convey runoff, however, allow for positive overflow to the surrounding streets based on historic drainage conditions. Refer to Attachment A of this report for the Preliminary WQMP Exhibit. *Post-Project perviousness was assumed to be 15% based on the proposed land use and density of the development. During final engineering, actual pervious coverage will be calculated as landscape plans become available.

II.2 Potential Stormwater Pollutants

Pollutants of Concern			
Pollutant	Circle One: E=Expected to be of concern N=Not Expected to be of concern		Additional Information and Comments
Suspended-Solid/ Sediment	**E**	N	Expected by proposed landscaped areas.
Nutrients	**E**	N	Expected by proposed landscaped areas.
Heavy Metals	**E**	N	Tributary by uncovered parking areas.
Pathogens (Bacteria/Virus)	**E**	N	Expected by proposed residence and pets.
Pesticides	**E**	N	Expected by proposed landscaped areas.
Oil and Grease	**E**	N	Expected by uncovered parking areas.
Toxic Organic Compounds	**E**	N	Expected by uncovered parking areas.
Trash and Debris	**E**	N	Expected by proposed residence.

II.3 Hydrologic Conditions of Concern

☒ No – Show map

☐ Yes – Describe applicable hydrologic conditions of concern below. *Refer to Section 2.2.3 in the TGD.*

Per the TGD Figure 1, Susceptibility Analysis of San Gabriel-Coyote Creek dated February 2013, the project site is not indicated as a potential area of erosion, habitat, and physical structure susceptibility. The project site indirectly drains to the San Gabriel River, however it is downstream of the unstable portion of the river. Therefore, HCOCs do not exist. Refer to Attachment B for a the TGD Figure.

II.4 Post Development Drainage Characteristics

Post–development drainage will be consistent with a proposed attached Multi-Family Residential project. The tributary areas and direction of run-off flows for the proposed site are delineated on the enclosed Preliminary WQMP Exhibit based on the grading and drainage design. Refer to the Preliminary WQMP Exhibit in Attachment A of this report.

Proposed drainage runoff will be collected by a series of area drains and proposed sump curb inlet catch basins within the proposed private drive aisles and conveyed to seven (7) proposed Modular Wetlands Systems (MWS) Biofiltration systems for water quality treatment. The proposed MWS biofiltration systems and catch basins will be equipped with internal peak bypass weirs and upstream diversion systems for conveyance of larger storm events. Stormwater runoff from the proposed site will be directed offsite via proposed underground storm drain piping to the existing catch basin/ storm drain system within Orange Avenue and continue flowing easterly to the Lincoln Storm Drain and Carbon Creek Channel.

The proposed drainage pattern matches the existing historical drainage pattern from the site. Runoff from this area historically flows in both the west and southerly directions and ultimately enters Coyote Creek Channel and San Gabriel River which ultimately discharges to the Pacific Ocean.

II.5 Property Ownership/Management

The property is currently owned by Melia Homes. The Owner will be responsible for the long-term maintenance of the project's storm water facilities and conformance to this WQMP after construction is complete.

A Notice of Transfer of Responsibility is located in Attachment F of this report and should be executed as part of any ownership transfer after construction is complete.

Melia Homes will appoint a Homeowner's Association (HOA) and/ or Property Management Company (PMC) to provide long term BMP maintenance for the proposed development. Refer to Section V of this report for additional information.

Melia Homes

Chad Brown, Vice President of Planning & Development

2951 Research Drive, Suite 100, Irvine, CA 92618

(949) 759-4367/ chad@melia-homes.com

Section III Site Description

III.1 Physical Setting

Planning Area/ Community Name	City of Cypress
Location/Address	9470 Moody Street
	Cypress, CA 90630
Land Use	Existing - Educational Facilities Proposed - Residential
Zoning	Existing – Public and Semi-Public (PS) Proposed – Multi-Family Residential (RM-20/ RM-15)
Acreage	6.34 ac
Predominant Soil Type	Per TGD, Figure XVI-2a, NRCS Hydrologic Soils Groups the site is located within **Soil Type B**. Refer to Attachment B of this report for a copy of the map. **For site specific soil information, refer to Section III.2 and Attachment E of this report.**

III.2 Site Characteristics

Precipitation Zone	The site falls under the 0.90" per the TGD, Figure XVI-1, Rainfall Zones map. Refer to Attachment B of this report for a copy of the map.
Topography	The site topography is relatively flat and sheet flows towards the project's western and southern boundaries. The site ranges in elevations from approximately 47.3' to 36.8'.
Drainage Patterns/Connections	The westerly half of the existing site drains towards Moody Street to the west, with some portions of the existing parking lot draining to the south towards Orange Avenue. The easterly half of the existing site drains to the south towards Orange Avenue. Existing drainage is conveyed vis surface runoff overland. There are no visible existing storm drain facilities located

	onsite. An existing public City of Cypress 42" reinforced concrete pipe storm drain system is located within Orange Avenue, flowing in the westerly direction. An existing catch basin is located near the northeast corner of Orange Avenue at Moody Street that connects to the existing storm drain system within Orange Avenue. Stormwater runoff that enters the existing storm drain system within Orange Avenue continues flowing in the westerly direction, where converging with the Lincoln Storm Drain (OCFCD Facility No. B00P01) and Carbon Creek Channel (OCFCD Facility No. B01), then the Coyote Creek and San Gabriel River, ultimately to the discharging to the Pacific Ocean.
Soil Type, Geology, and Infiltration Properties	Per the Updated Geotechnical Evaluation prepared by GeoTek, Inc. dated January 4, 2021, the site's geotechnical properties are described as the following: "Undocumented fill was encountered in some of our borings to approximately 3 to 4 feet below grade. The fill consisted of brown, moist, loose silty sand. The fill is likely associated with the current use of the site and may be thicker beneath existing building areas. In addition, stockpile soil up to 8 feet in height is situated within the northeastern portion of the site." "Younger alluvium was encountered in our borings below the fill or at near ground surface and extended to the maximum depth explored of about 13 feet. The alluvium encountered generally consisted of brown to brownish gray, moist to very moist, soft sandy silt and loose to medium silty sand. The logs of the exploratory borings and data from the CPT soundings performed by NMG show similar conditions with soft/loose alluvial materials up to a depth of 15 feet. Below 15 feet, the alluvium has alternating layers of silty sand, sandy silt, poorly graded sand, clay, and silty clay which are in a medium dense to dense/stiff state." "According to the test results by NMG and GeoTek, the near surface site-soils have a "very low" expansion potential when tested and classified in accordance with ASTM D 4829. Also, consolidation tests performed by GeoTek on relatively undisturbed samples of the upper 10 feet of the alluvium showed that these soils are moderately compressible and have slight to moderate potential for collapse." Refer to Attachment E of this report for a copy of the geotechnical report.

Site Characteristics (continued)	
Hydrogeologic (Groundwater) Conditions	Per the Updated Geotechnical Evaluation prepared by GeoTek, Inc. dated January 4, 2021, the site's hydrogeologic (Groundwater) conditions are described as the following: "Groundwater was not encountered in our exploratory borings performed to a maximum depth of 13 feet. However, groundwater was found in NMG's borings at 8 and 10 feet below the ground surface at the time of drilling (see logs in Appendix A). Historically highest groundwater at the site is reported to be about 10 feet below ground surface based on the Seismic Hazard Zone Report for Los Alamitos 7.5-Minute Quadrangle (California Department of Conservation, 1998). The GeoTracker database (https://geotracker.waterboards.ca.gov/) indicates that groundwater monitoring wells were installed on site to evaluate the impact of an old leaking underground fuel tank. Groundwater levels were reported to fluctuate between 4 and 8 feet below grade. It is possible that seasonal variations (temperature, rainfall, etc.) will cause fluctuations in the groundwater level. The groundwater levels presented in this report are the levels that were measured at the time of our field activities. It is recommended that the contractor determine the actual groundwater levels at the site at the time of the construction activities to determine the impact, if any, on the construction procedures." Refer to Attachment E of this report for a copy of the geotechnical report.
Geotechnical Conditions (relevant to infiltration)	Due to high groundwater based on geotechnical site borings and historic data, infiltration testing was not performed as it is assumed infiltration BMPs will be infeasible on this site.
Off-Site Drainage	No off-site drainage enters the property.
Utility and Infrastructure Information	Utilities are proposed to be underground. No special setbacks are needed or proposed. Proposed domestic water, storm drain, sanitary sewer and underground fire water system will be private and maintained by the appointed HOA and/ or PMC.

III.3 Watershed Description

Receiving Waters	Site runoff drains towards the surrounding rights-of-way of the site and the existing public storm drain system that converges with the Lincoln Storm Drain and discharges to the Carbon Creek Channel, then to Coyote Creek and San Gabriel River, ultimately discharging to the Pacific Ocean. The site is located within the San Gabriel-Coyote Creek Watershed.
303(d) Listed Impairments	**Coyote Creek –** Dissolved Copper, Indicator Bacteria, Iron, Malathion, pH, Toxicity
Applicable TMDLs	**Coyote Creek –** Dissolved Copper, Indicator Bacteria, Lead
Pollutants of Concern for the Project	Anticipated and Potential Pollutants of Concern for Attached Residential Development and Uncovered Parking Areas is Suspended Solid/Sediments, Nutrients, Heavy Metals, Pathogens (Bacteria/Virus), Pesticides, Oil & Grease, Toxic Organic Compounds and Trash & Debris.
Environmentally Sensitive and Special Biological Significant Areas	The project is not located within any known Environmentally Sensitive Areas (ESA) or Areas of Special Biological Significance (ASBS).

Section IV Best Management Practices (BMPs)

IV. 1 Project Performance Criteria

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

Project Performance Criteria (continued)	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	Per 7.II-2.4.2.2 of the MWQMP, HCOCs exist when the proposed condition of the site generates a decrease in the time of concentration beyond 5% and an increase in runoff volume beyond 5% for the 2-year storm event, thus potentially increasing downstream erosion. Since the project proposes to utilize infiltration BMPs which will infiltrate a volume that is greater than the increase in runoff volume, the project will not contribute to erosion of downstream drainage facilities. In addition, although the project site drains to the San Gabriel River, the site is located downstream of the unstable portion of the river.
List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)	According to Section 7.II-2.4.3 of the MWQMP Priority Projects must biotreat/biofilter the 85th percentile, 24-hour storm event (Design Capture Volume). A properly designed biotreatment system may only be considered if infiltration, harvest and use, and evapotranspiration (ET) cannot be feasibly implemented for the full design capture volume. In this case, infiltration, harvest and use, and ET practices must be implemented to the greatest extent feasible and biotreatment be provided for the remaining design capture. This project proposes to utilize infiltration BMPs to treat the required stormwater runoff volume. Biotreatment BMPs will also be utilized as a form of pre-treatment prior to entering the proposed infiltration systems. Portions of the roof and sidewalk runoff will be directed to landscape areas to promote natural filtration and pre-treatment prior to entering into an area drain system that directly connects to the proposed Infiltration System.
List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP)	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 off-site prior to discharge to waters of the US. Since the project proposes to satisfy LID performance criteria, therefore treatment control performance criteria is also fully satisfied. Sizing of treatment control BMPs (Biofiltration Systems) shall be based flow-based for the area being redeveloped to medium and high effectiveness for reducing the primary pollutants of concern, which will be considered in compliance. This project proposes to utilize a combination of infiltration BMPs and biotreatment BMPs to treat the required stormwater runoff. Refer to Attachment C for manufacturer's specifications for the proposed infiltration and biotreatment BMPs. Refer to Section IV.3.2, Infiltration BMPs and Section IV.3.4, Biotreatment BMPs for additional information regarding BMP selection.

Calculate LID design storm capture volume for Project.	Biotreatment BMPs will be utilized for the required water quality treatment flow rate. The DCV for each DMA was calculated as follows: DMA 1: V_{design} = 0.79*0.90*3.00 ac*43,560 (sf/ac)*(1 ft/12 in) = 7,726 cf DMA 2: V_{design} = 0.79*0.90*0.45 ac*43,560 (sf/ac)*(1 ft/12 in) = 1,162 cf DMA 3: V_{design} = 0.79*0.90*0.64ac*43,560 (sf/ac)*(1 ft/12 in) = 1,641 cf DMA 4: V_{design} = 0.79*0.90*0.24 ac*43,560 (sf/ac)*(1 ft/12 in) = 625 cf DMA 5: V_{design} = 0.79*0.90*0.51 ac*43,560 (sf/ac)*(1 ft/12 in) = 1,314 cf DMA 6: V_{design} = 0.79*0.90*0.45 ac*43,560 (sf/ac)*(1 ft/12 in) = 1,160 cf DMA 7: V_{design} = 0.79*0.90*1.04 ac*43,560 (sf/ac)*(1 ft/12 in) = 2,678 cf The total DCV for the entire site is 16,306 cf. The design flowrate for each DMA was calculated as follows: DMA 1: Q_{design} = 0.79*0.26 (in/hr)*3.00 ac = 0.615 cfs DMA 2: Q_{design} = 0.79*0.26 (in/hr)*0.45 ac = 0.092 cfs DMA 3: Q_{design} = 0.79*0.26 (in/hr)*0.64 ac = 0.131 cfs DMA 4: Q_{design} = 0.79*0.26 (in/hr)*0.24 ac = 0.050 cfs DMA 5: Q_{design} = 0.79*0.26 (in/hr)*0.51 ac = 0.105 cfs DMA 6: Q_{design} = 0.79*0.26 (in/hr)*0.45 ac = 0.092 cfs DMA 7: Q_{design} = 0.79*0.26 (in/hr)*1.04 ac = 0.213 cfs The total design flowrate for the entire site is 1.298 cfs. Refer to Attachment B of this report for Worksheet B and D, DCV and treatment flowrate calculations.

IV.2. SITE DESIGN AND DRAINAGE PLAN

The site proposes seven (7) Drainage Management Areas (DMA) as indicated on the Preliminary WQMP Exhibit. The DMAs are based on the Grading and Drainage design. Each DMA will have an area drain system to collect and convey runoff from landscape, surface, and roof drainage to the proposed treatment devices. Pervious coverages located throughout the site will promote impervious area dispersion from roof and sidewalk runoff.

Street surface runoff will be captured by curb inlet catch basins equipped with Dvert Systems which will divert low flows to proposed Modular Wetlands System (MWS) Biofiltration systems for water quality treatment of the required design flowrate. The proposed MWS Biofiltration systems and catch basins will be equipped with internal peak bypass weir systems for conveyance of larger storm events. Treated and overflow stormwater runoff will be conveyed via a proposed private underground storm drain system to two (2) public point of connections to an existing City public 42" storm drain system within Orange Avenue.

The Modular Wetland System (MWS) Biofiltration vaults are designed to provide a 3-phase treatment train. Initially, when the stormwater enters the system, a trash rack, filter media and settling chamber will capture large trash/ debris and sediment in the stormwater before entering the planting media. This system is designed to treat stormwater flow horizontally. Before the stormwater enters the planting or "wetland" chamber, the runoff flows through the 2nd phase, a pre-filter cartridge which captures fines TSS, metals, nutrients, and bacteria. The pre-filter chamber eliminates additional maintenance of the planting area. The wetland chamber is the 3rd phase of the system which provides final treatment through a combination of physical, chemical, and biological processes. Refer to Section IV.3.4 of this report for sizing information of the MWS Biofiltration Systems.

Refer the Preliminary WQMP Exhibit in Attachment A for the location of the proposed BMPs. Refer to Attachment C for manufacturer's specifications of the selected BMPs.

IV.3 LID BMP SELECTION AND PROJECT CONFORMANCE ANALYSIS

IV.3.1 Hydrologic Source Controls

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

** HSC BMPs are not applicable to this site as HCOCs are not required. Refer to Section II.3 for additional information.*

IV.3.2 Infiltration BMPs

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

Due to high groundwater levels based on geotechnical borings and historic levels, infiltration BMPs are considered infeasible on this site. Refer to Attachment B for the Infiltration Feasibility Worksheet for additional information.

IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

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

Evapotranspiration, Rainwater Harvesting BMPs will not be utilized and have been determined to be infeasible for this site due to development type, density, and available amount of landscaped area for irrigation purposes. Refer to Worksheet J for feasibility calculations within Attachment B of this report.

IV.3.4 Biotreatment BMPs

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

Modular Wetland System (MWS) Biofiltration vaults will be utilized for water quality treatment of design flow rate. The MWS Biofiltration vaults utilize a 3-phase treatment train by collecting the stormwater runoff in a Pre-Treatment Chamber, Planting or "Wetland" Chamber and Discharge Chamber. Treated stormwater runoff will discharge to an existing public storm drain system within Orange Avenue.

The MWS Biofiltration systems were sized separately per DMA using the treatment flow rate method per the Orange County Technical Guidance Document worksheets.

Refer to Worksheet D in Attachment B for calculations. Refer to the Preliminary WQMP Exhibit in Attachment A for areas that were excluded from MWS sizing calculations.

DMA	Tributary Area (ac)	Treatment Flowrate, Q (cfs)	MWS Model	Treatment Capacity, Q (cfs)
1	3.00	0.615	(2) MWS-8-12	0.692
2	0.45	0.092	MWS-4-8	0.115
3	0.64	0.131	MWS-4-8*	0.131
4	0.24	0.050	MWS-4-8	0.115
5	0.51	0.105	MWS-4-8	0.115
6	0.45	0.092	MWS-4-8	0.115
7	1.04	0.213	MWS-8-12	0.346

Total	6.34	1.298	--	1.629

**Modified depth of selected model. Project specific details to be provided during final engineering. Refer to manufacturer flow-rate matrix and model information located within Attachment C.*

Conclusion:

The utilization of a MWS Biofiltration systems will provide more than the required treatment flow rate based on tributary area.

GIS Coordination of MWS Systems

GIS information to be provided during final engineering.

IV.3.5 Hydromodification Control BMPs

Hydromodification Control BMPs	
BMP Name	**BMP Description**
n/a	n/a

IV.3.6 Regional/Sub-Regional LID BMPs

Regional/Sub-Regional LID BMPs
Not Applicable for this project.

IV.3.7 Treatment Control BMPs

Treatment Control BMPs	
BMP Name	**BMP Description**
n/a	n/a

IV.3.8 Non-structural Source Control BMPs

Non-Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**If not applicable, state brief reason**
		Included	**Not Applicable**	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	
N6	Local Industrial Permit Compliance	☐	☒	Proposed residential project
N7	Spill Contingency Plan	☐	☒	Proposed residential project
N8	Underground Storage Tank Compliance	☐	☒	Proposed residential project
N9	Hazardous Materials Disclosure Compliance	☐	☒	Hazardous materials will not be stored onsite
N10	Uniform Fire Code Implementation	☒	☐	
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	Proposed residential project
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	Proposed residential project

N1: Education for Property Owners, Tenants & Occupants

Project conditions of approval will require that the Homeowner's Association (HOA) periodically provide environmental awarness education materials, made available by the municipalities, to all of its members. Among other things, these materials will be descrive the use of chemcials (including household type) that should be limited to the property, with no discharge of wastes via hosing or other direct discharge to gutters,

catch basins and storm drains. Educational materials available from the County of Orange can be downloaded here:

http://www.ocwatersheds.com/PublicEd/resources/default.aspx

N2: Activity Restrictions

Conditions, covenants and restrictions (CC&Rs) must be prepared by the developer for the appointed HOA for the purpose of surface water quality protection. The CC&Rs shall incorporate the restrictions based on the Project WQMP.

N3: Common Area Landscape Management

All common landscaping and/ or open space areas shall have on-going landscape maintenance by an appointed professional landscaping maintenance company as selected by the HOA. Maintenance shall incorporate all current County Water Conservation Resolution usage and follow the Management Guidelines for Use of Fertilizers per the DAMP Section 5.5. Refer to Section 5 of this report for additional landscape maintenance requirements.

N4: BMP Maintenance

Refer to Section 5 and Attachment G of this report for additional non-structural BMP maintenance requirements, responsibility and frequency.

N5: Title 22 CCR Compliance

HOA is responsible for compliance with Title 22 of the California Code of Regulations (CCR) and relevant sections of the California Health & Safety Code regarding hazardous waste management is enforced by the County Environmental Heath and behalf of the State. Inforamtion regarding hazardous waste management must be provided to all employees, homeowners, tenants and occupants.

N9: Hazardous Materials Disclosure Compliance

HOA is responsible for compliance with the local agencies' ordinances enforced by City Fire Department for the management of hazardous materials including enforcement, waste handling, disposal regulations and documentation.

N10: Uniform Fire Code Implementation

HOA is responsible for compliance with Article 80 of the Uniform Fire Code enforced by the local fire protection agency.

N11: Common Area Litter Control

HOA to implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water. HOA to contract with landscape maintenance company to provide this service during regularly scheduled maintenance, which will consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposals violations by homeowners, tenants or occupants and reporting the violations to the HOA for investigation.

N12: Employee Training

HOA to provide Educational Materials and Property Management manuals to all employees upon initial hiring. Any updated information shall be provided to employees within a timely manner along with information on implementation.

N14: Common Area Catch Basin Inspections

HOA to inspect, clean and repair common area catch basins within the development to verify that the private drainage system is working properly. All trash/ debris and sediment build up is removed and any repairs/ replacements are conducted. Cleaning should take place in late summer/ early fall prior to the start of the raining season. Drainage facilities include catch basins (storm drain inlets), detention basins, retention basins, sediment basins, open drainage channels, area drains, and lift stations. Records shall be kept onsite to document the annual maintenance.

N15: Street Sweeping of Private Streets & Parking Lots

HOA to schedule at a minimum street sweeping of private streets and parking areas prior to the start of the rainy seasons, in late summer or early fall. Additional sweeping may be required to remove landscaping foliage and/ or pollution.

IV.3.9 Structural Source Control BMPs

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

S1 (CASQA Fact Sheet SD-13): Storm Drain Stenciling & Signage

HOA to inspect, repair and/ or replace storm drain stenciling and signage immediately. Inspection of stenciling and signage shall occur at least once per month and prior to the start of the raining season. Storm Drain stenciling and signage with a reference that indicates "Drains to Ocean" per CASQA BMP SD-13 Fact Sheet is required.

S4 (CASQA Fact Sheet SD-12): Use Efficient Irrigation Systems & Landscape Design

HOA shall implement the timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm drain systems. HOA to implement the following methods to reduce excessive irrigation water runoff, where applicable:

- Employ rain shutoff devices to prevent irrigation after precipitation
- Utilizing landscape specific irrigation water requirements
- Utilize flow reducers or shutoff valves triggered by pressure drop to control water loss due to broken sprinkler heads
- Implement landscaping practices per the County Water Conservation Resolution or City agency equivalent
- Group plants or landscaping with similar water consumption to promote surface infiltration

Refer to CASQA BMP Fact Sheet SD-12 for additional information.

IV.4 ALTERNATIVE COMPLIANCE PLAN (IF APPLICABLE)

IV.4.1 Water Quality Credits

<table>
<tr><th colspan="5">Description of Proposed Project</th></tr>
<tr><td colspan="5">Project Types that Qualify for Water Quality Credits (Select all that apply):</td></tr>
<tr><td colspan="2">☐Redevelopment projects that reduce the overall impervious footprint of the project site.</td><td colspan="2">☐Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants, or contaminants, and which have the potential to contribute to adverse ground or surface WQ if not redeveloped.</td><td>☐ 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).</td></tr>
<tr><td colspan="2">☐ 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).</td><td colspan="2">☐ 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</td><td>☐ 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).</td></tr>
<tr><td>☐Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses.</td><td>☐ Developments in a city center area.</td><td>☐ Developments in historic districts or historic preservation areas.</td><td>☐ 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.</td><td>☐In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas.</td></tr>
<tr><td>Calculation of Water Quality Credits
(if applicable)</td><td colspan="4">Water Quality credits will not be utilized on this development site.</td></tr>
</table>

IV.4.2 Alternative Compliance Plan Information

n/a

Section V Inspection/Maintenance Responsibility for BMPs

The property is currently owned by Melia Homes. The Owner will be responsible for the long-term maintenance of the project's storm water facilities and conformance to this WQMP after construction is complete.

A Notice of Transfer of Responsibility is located in Attachment F of this report and should be executed as part of any ownership transfer after construction is complete.

Estimated annual budget for maintenance of proposed proprietary BMPs is approximately $1,200 per unit per year. Refer to manufacturer's specifications located within Attachment C for additional information.

The owner will appoint a Homeowner's Association (HOA) to provide long term BMP maintenance for the proposed development upon completion of construction.

Owner/ Developer:
Melia Homes
8951 Research Drive, Suite 100
Irvine, CA 92618
(949) 759-4367
Chad Brown, Vice President of Planning & Development
chad@melia-homes.com

Homeowner's Association and/ or Property Management Company
To be determined

If there is evidence of standing water within drainage system for more than 48 hours, contact Orange County Mosquito and Vector Control District at (714) 971-2421 or (949) 654-2421 for appropriate measures.

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
Education for Property Owners, Tenants, Occupants & Employees	Homeowner's Association (HOA) and/ or Property Management Company (PMC)	HOA/ PMC to provide education material, a copy of the approved WQMP and Operation & Maintenance Plan (O&M) to new property owners, tenants, occupants & employees.	At time of hiring, leasing and/ or home purchase.
Activity Restrictions	HOA/ PMC	HOA/ PMC employees notified of activities that are prohibited by homeowners.	Restrictions identified in Employee Manual and reviewed yearly by employees.
Common Area Landscape Management	HOA/ PMC	HOA/ PMC to hire professional landscape company to conduct maintenance of landscaping to meet current water efficiency and keep plants healthy and bio areas maintained with proper soil amendments.	Regular maintenance once a week and monthly inspection to determine deficiencies.
BMP Maintenance	HOA/ PMC	HOA/ PMC to hire professional BMP maintenance company to conduct regular inspections, repairs, and cleanings per manufacturer's specifications.	A minimum 2 inspections/ cleanings per year per manufacturer's specifications prior to October 1st (before rainy season)
Title 22 CCR Compliance	HOA/ PMC	The distribution of these materials will be the responsibility of the HOA/ PMC at the time of hire, lease signing or home	At time of hiring, leasing and/ or home purchase.

		purchase per property owner, tenant, or occupant or at the initial time of hiring.	
Uniform Fire Code Implementation	HOA/ PMC	HOA/ PMC to comply with fire regulations and keep informed of the latest rules and requirements.	Comply with annual fire inspections and maintain building and access per the latest fire codes.
Common Area Litter Control	HOA/ PMC	HOA/ PMC to provide litter removal of site parking lot and landscape areas and to empty common area trash bins.	Once per week.
Employee Training	HOA/ PMC	The distribution of these materials will be the reasonability of the HOA/ PMC at the initial hiring of the employee.	At time of hiring.
Private Street & Parking Lot Sweeping	HOA/ PMC	HOA/ PMC to provide maintenance of Parking Lot and provide Street Sweeping services.	Weekly basis.
Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	HOA/ PMC	HOA/ PMC to provide maintenance of landscaping to meet current water efficiency standards and keep plants healthily.	Regular maintenance once a week and monthly inspection to determine any water deficiencies.
Common Area Catch Basin Inspections	HOA/ PMC	HOA/ PMC shall inspection common areas where catch basins are located within the surrounding area and remove any trash/ debris.	Inspections/ Cleaning shall occur at least twice per month.

Storm Drain System Stencilling & Signage	HOA/ PMC	H HOA/ PMC to inspect and repair as needed all onsite storm drain stencilling & signage.	Inspection should occur at minimum twice per year.
Modular Wetlands System (MWS) Biofiltration Vaults	HOA/ PMC	HOA/ PMC will be required to hire a professional maintenance company to provide regular inspections, repairs, and cleaning per manufacturer's specifications.	Inspections/ Cleanings should occur at least two times per year and before the start of the rainy season (October 1st). Refer to Attachment C for additional information and manufacturer's specifications.
Modular Trough Diversion System	HOA/ PMC	HOA/ PMC to inspect system and schedule maintenance when deficiencies are noted. Area near system to be kept free of debris and cleanings shall be scheduled to remove silt from trough as needed	Inspections should occur at least two times per year and before the start of the rainy season (October 1st).

Section VI Site Plan and Drainage Plan

VI.1 SITE PLAN AND DRAINAGE PLAN

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural BMP locations
- Drainage delineations and flow information
- Drainage connections
- BMP details

VI.2 ELECTRONIC DATA SUBMITTAL

The minimum requirement is to provide submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open.

If the local jurisdiction requires specialized electronic document formats (CAD, GIS) to be submitted, this section will be used to describe the contents (e.g., layering, nomenclature, georeferencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

Section VII Educational Materials

Refer to the Orange County Stormwater Program (www.ocwatersheds.com) for a library of materials available.

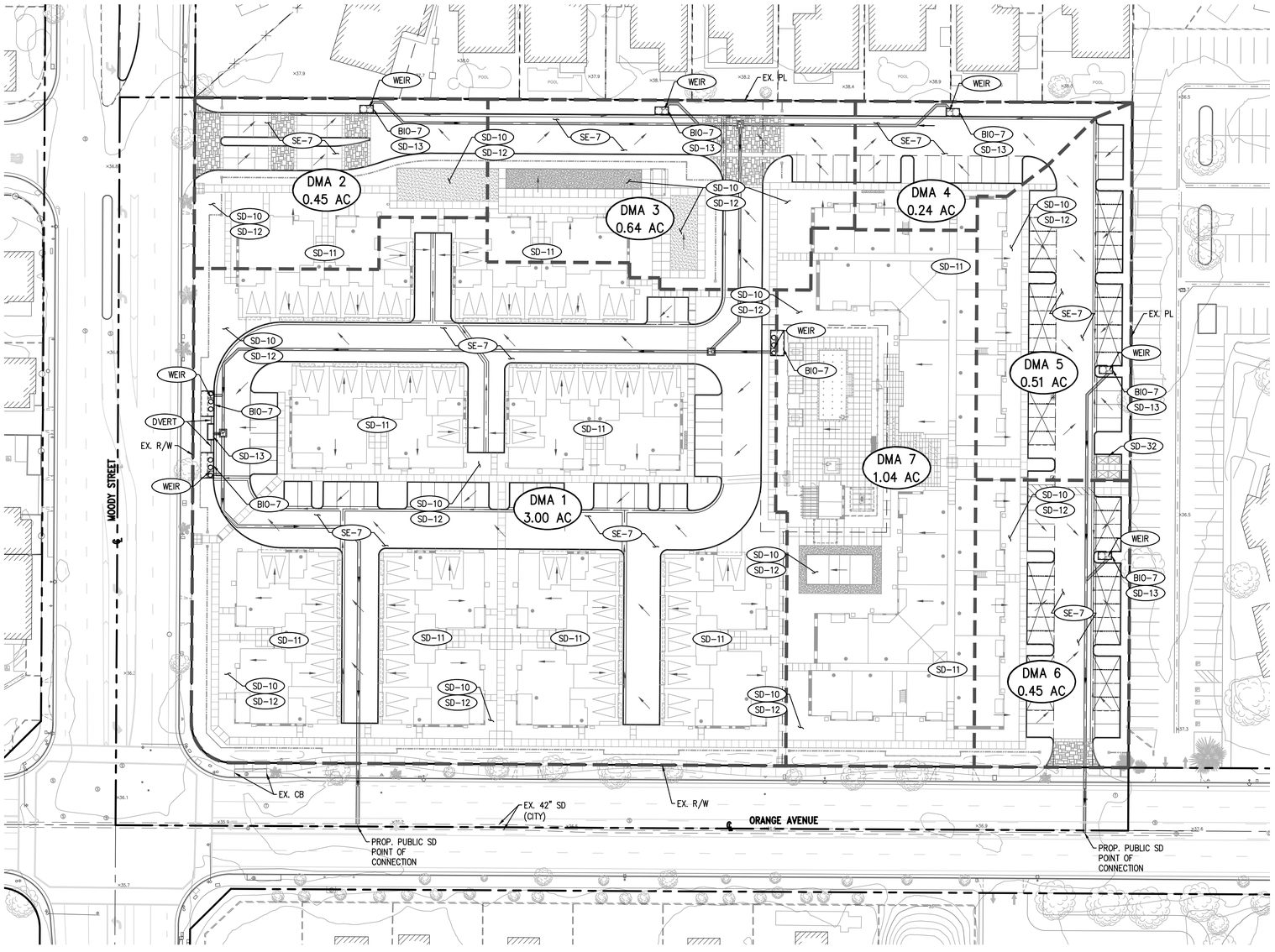
Education Materials			
Residential Material (http://www.ocwatersheds.com)	**Check If Applicable**	**Business Material (http://www.ocwatersheds.com)**	**Check If Applicable**
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☐	Tips for Using Concrete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

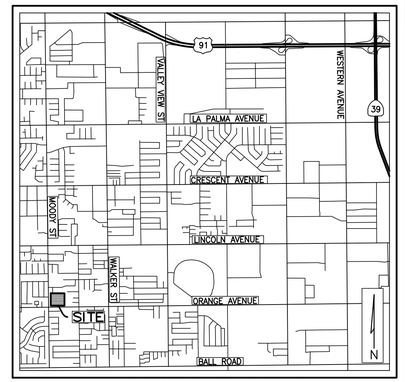
ATTACHMENT A

Preliminary WQMP Exhibit

PRELIMINARY WQMP EXHIBIT

TR 19147
9470 MOODY SREET
CITY OF CYPRESS, COUNTY OF ORANGE





VICINITY MAP
NTS

LEGEND

- EXISTING RIGHT-OF-WAY/ BOUNDARY
- PROPOSED RIGHT-OF-WAY/ BOUNDARY
- DRAINAGE MANAGEMENT AREA (DMA)
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- RUNOFF FLOW ARROWS
- STORM DRAIN FLOW ARROWS
- PROPOSED MWS BIOFILTRATION VAULT
- PROPOSED CATCH BASIN
- PROPOSED LANDSCAPING
- PROPOSED ASPHALT CONCRETE (AC) PAVEMENT
- PROPOSED TURF
- PROPOSED PCC PAVEMENT
- PROPOSED DECORATIVE PAVEMENT
- DMA X / X.XX AC — DRAINAGE MANAGEMENT AREA (DMA) / ACREAGE
- X.X AC — ACREAGE OF AREA EXCLUDED FROM MWS SIZING CALCULATIONS
- ROOF DOWNSPOUT

STORM DRAIN SIGNAGE (SD-13)

BEST MANGEMENT PRACTICES (BMPS)

- SD-10 — SITE DESIGN & LANDSCAPE PLANNING
- SD-11 — ROOF RUNOFF CONTROLS
- SD-12 — EFFICIENT IRRIGATION
- SD-13 — STORM DRAIN SIGNAGE
- SD-32 — TRASH ENCLOSURE
- SE-7 — STREET SWEEPING & VACUUMING
- BIO-7 — PROPRIETARY BIOTREATMENT – MODULAR WETLANDS SYSTEM (MWS) BIOFILTRATION VAULT
- DVERT — PROPRIETARY DVERT SYSTEM FOR MODULAR WETLANDS SYSTEM (MWS)
- WEIR — PROPRIETARY INTERAL WEIR SYSTEM FOR MODULAR WETLANDS SYSTEM (MWS)

SCALE: 1" = 40'

0 20 40 80

DEVELOPER :

REVISIONS

NO.	DATE	INITIAL	DESCRIPTION	APP	DATE

OWNER & DEVELOPER :

MELIA HOMES
8951 RESEARCH DRIVE, #100
IRVINE, CA 92618
PHONE (949) 759-4367

SOILS ENGINEER :

PREPARED BY :

C&V CONSULTING, INC.
CIVIL ENGINEERING
LAND PLANNING & SURVEYING
9830 IRVINE CENTER DRIVE
IRVINE, CALIFORNIA 92618
(949) 916-3800
INFO@CVC-INC.NET
WWW.CVC-INC.NET

REGISTERED PROFESSIONAL ENGINEER
DANE P. McDOUGALL
C 80705
CIVIL
STATE OF CALIFORNIA

TRACT NO. 19147
PRELIMINARY WQMP EXHIBIT

DATE: 5/24/2021
SHEET 1 OF 1

SCALE: AS SHOWN | DRAWN BY: JH | CHECKED BY: JH

CITY OF CYPRESS

ATTACHMENT B

TGD Figures, Worksheets & Reference Materials

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: Per the Updated Geotechnical Evaluation prepared by GeoTek, Inc. dated January 4, 2021, the site's hydrogeologic (Groundwater) conditions are described as the following: "Groundwater was not encountered in our exploratory borings performed to a maximum depth of 13 feet. However, groundwater was found in NMG's borings at 8 and 10 feet below the ground surface at the time of drilling (see logs in Appendix A). Historically highest groundwater at the site is reported to be about 10 feet below ground surface based on the Seismic Hazard Zone Report for Los Alamitos 7.5-Minute Quadrangle (California Department of Conservation, 1998). The GeoTracker database (https://geotracker.waterboards.ca.gov/) indicates that groundwater monitoring wells were installed on site to evaluate the impact of an old leaking underground fuel tank. Groundwater levels were reported to fluctuate between 4 and 8 feet below grade." Due to high groundwater levels based on geotechnical borings and historic data, infiltration BMPs are considered infeasible for this site. Refer to Attachment E of this report for a copy of the geotechnical report.			
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:			
3	Would infiltration of the DCV from drainage area **violate downstream water rights**?		X
Provide basis:			

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:			
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: Due to high groundwater levels based on geotechnical borings and historic data, infiltration BMPs are considered infeasible for this site. Refer to Attachment E of this report for a copy of the geotechnical report.			
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:			

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

7	Would **an increase in infiltration over predeveloped conditions cause impairments to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?**		X
Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible:			
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:		Yes
9	If any answer from row 1-3 is yes: infiltration of any volume is **not feasible** within the DMA or equivalent. Provide basis:		No
10	If any answer from row 4-7 is yes, infiltration is **permissible but is not presumed to be feasible for the entire DCV.** Criteria for designing biotreatment BMPs to achieve the maximum feasible infiltration and ET shall apply. Provide basis:		No
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.		Infiltration is Not Feasible

DMA 1

Worksheet B: Simple Design Capture Volume Sizing Method

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.90	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.90	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	3.00	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.85	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.79	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	7,726	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)	$K_{measured}$=		In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=		
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=		In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=		Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=		feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=		sq-ft

DMA 2

Worksheet B: Simple Design Capture Volume Sizing Method

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.90	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.90	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.45	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.85	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.79	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	1,162	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)	$K_{measured}$=		In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=		
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=		In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=		Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=		feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=		sq-ft

DMA 3

Worksheet B: Simple Design Capture Volume Sizing Method

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.90	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.90	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.64	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.85	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.79	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	1,641	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)	$K_{measured}$=		In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=		
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=		In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=		Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=		feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=		sq-ft

DMA 4

Worksheet B: Simple Design Capture Volume Sizing Method

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.90	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.90	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.24	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.85	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.79	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	625	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)	$K_{measured}$=		In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=		
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=		In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=		Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=		feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=		sq-ft

DMA 5

Worksheet B: Simple Design Capture Volume Sizing Method

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.90	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.90	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.51	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.85	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.79	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	1,314	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)	$K_{measured}$=		In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=		
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=		In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=		Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=		feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=		sq-ft

DMA 6

Worksheet B: Simple Design Capture Volume Sizing Method

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.90	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.90	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.45	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.85	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.79	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	1,160	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)	$K_{measured}$=		In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=		
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=		In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=		Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=		feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=		sq-ft

DMA 7

Worksheet B: Simple Design Capture Volume Sizing Method

Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.90	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.90	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.04	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.85	
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.79	
4	Calculate runoff volume, V_{design}= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))*	V_{design}=	2,678	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)	$K_{measured}$=		In/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=		
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=		In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=		Hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=		feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=		sq-ft

DMA 1

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

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=	5.00	
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=	0.26	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	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	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1-I_2$	I_{design}=	0.26	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	3.00	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.85	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.79	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.615	cfs

Supporting Calculations

Describe system:
Stormwater runoff will be collected and conveyed to proposed MWS Biofiltration systems for water quality treatment prior to discharge offsite.

Provide time of concentration assumptions:
The time of concentration was assumed to be 5 minutes for conservative purposes to support preliminary calculations.

DMA 2

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

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=	5.00	
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=	0.26	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	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	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1-I_2$	I_{design}=	0.26	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.45	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.85	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.79	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.092	cfs
Supporting Calculations				
Describe system: Stormwater runoff will be collected and conveyed to proposed MWS Biofiltration systems for water quality treatment prior to discharge offsite.				
Provide time of concentration assumptions: The time of concentration was assumed to be 5 minutes for conservative purposes to support preliminary calculations.				

DMA 3

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

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=	5.00	
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=	0.26	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	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	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1-I_2$	I_{design}=	0.26	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.64	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.85	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.79	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.131	cfs

Supporting Calculations

Describe system:
Stormwater runoff will be collected and conveyed to proposed MWS Biofiltration systems for water quality treatment prior to discharge offsite.

Provide time of concentration assumptions:
The time of concentration was assumed to be 5 minutes for conservative purposes to support preliminary calculations.

DMA 4

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

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=	5.00	
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=	0.26	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	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	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1-I_2$	I_{design}=	0.26	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.24	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.85	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.79	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.050	cfs

Supporting Calculations

Describe system:
Stormwater runoff will be collected and conveyed to proposed MWS Biofiltration systems for water quality treatment prior to discharge offsite.

Provide time of concentration assumptions:
The time of concentration was assumed to be 5 minutes for conservative purposes to support preliminary calculations.

DMA 5

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

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=	5.00	
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=	0.26	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	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	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1-I_2$	I_{design}=	0.26	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.51	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.85	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.79	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.105	cfs
Supporting Calculations				
Describe system: Stormwater runoff will be collected and conveyed to proposed MWS Biofiltration systems for water quality treatment prior to discharge offsite.				
Provide time of concentration assumptions: The time of concentration was assumed to be 5 minutes for conservative purposes to support preliminary calculations.				

DMA 6

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

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=	5.00	
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=	0.26	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	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	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1-I_2$	I_{design}=	0.26	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	0.45	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.85	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.79	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.092	cfs
Supporting Calculations				
Describe system: Stormwater runoff will be collected and conveyed to proposed MWS Biofiltration systems for water quality treatment prior to discharge offsite.				
Provide time of concentration assumptions: The time of concentration was assumed to be 5 minutes for conservative purposes to support preliminary calculations.				

DMA 7

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

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=	5.00	
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=	0.26	in/hr
3	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
4	Enter capture efficiency corresponding to d_{HSC}, Y_2 (Worksheet A)	Y_2=	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	in/hr
6	Determine the design intensity that must be provided by BMP, $I_{design}= I_1-I_2$	I_{design}=	0.26	in/hr
Step 2: Calculate the design flowrate				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	1.04	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.85	
3	Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$	C=	0.79	
4	Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$	Q_{design}=	0.213	cfs

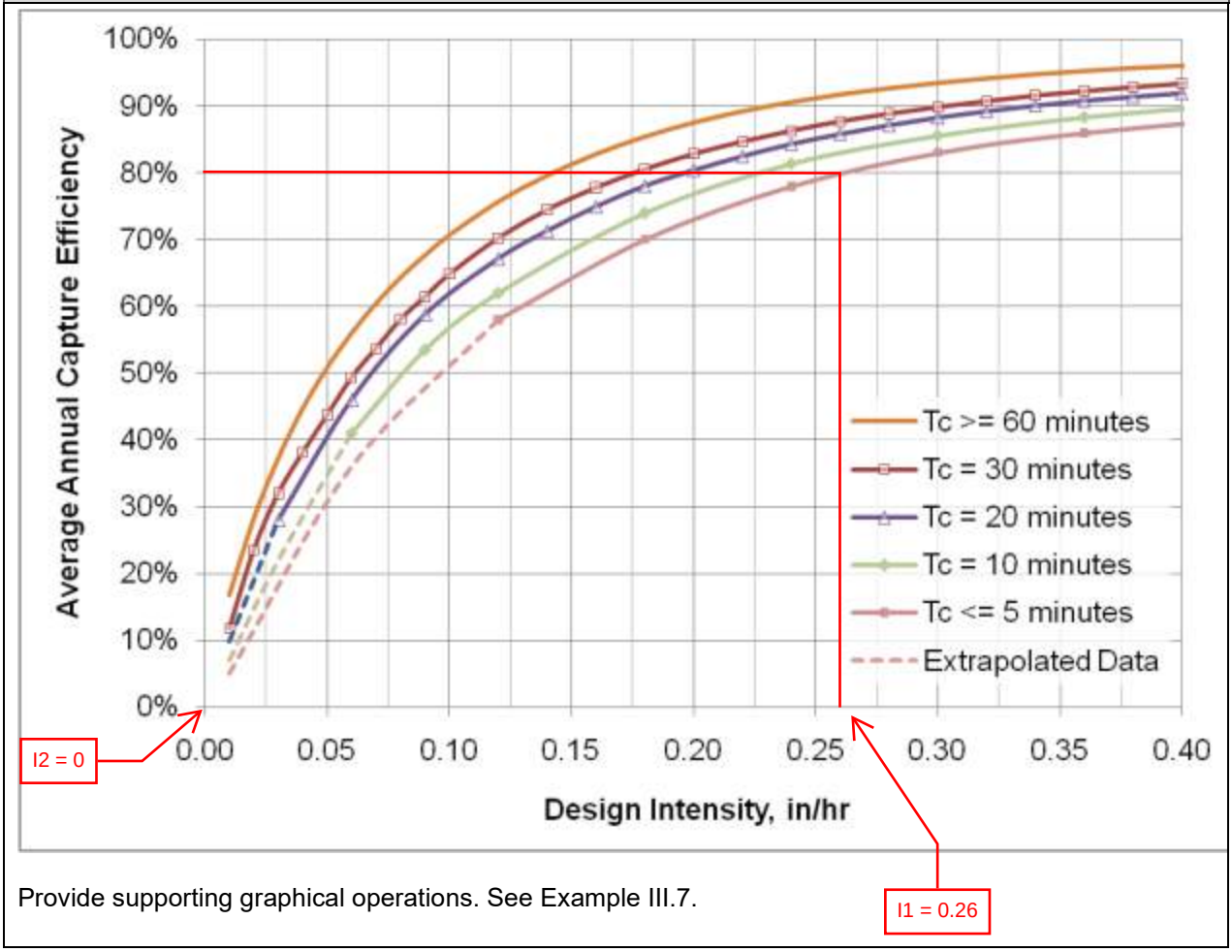
Supporting Calculations

Describe system:
Stormwater runoff will be collected and conveyed to proposed MWS Biofiltration systems for water quality treatment prior to discharge offsite.

Provide time of concentration assumptions:
The time of concentration was assumed to be 5 minutes for conservative purposes to support preliminary calculations.

Worksheet D: Capture Efficiency Method for Flow-Based BMPs

Graphical Operations



Provide supporting graphical operations. See Example III.7.

DMAs 2-6
Site-specific detail to be provided during final engineering

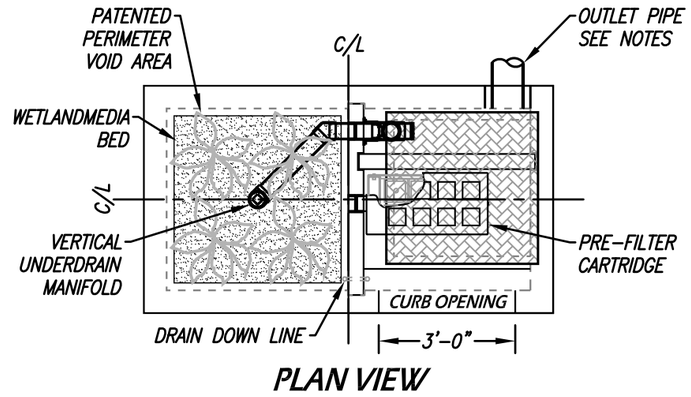
SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	36" x 36"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			2.37
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.22"
MAXIMUM PICK WEIGHT (LBS)			16500
NOTES:			

INSTALLATION NOTES

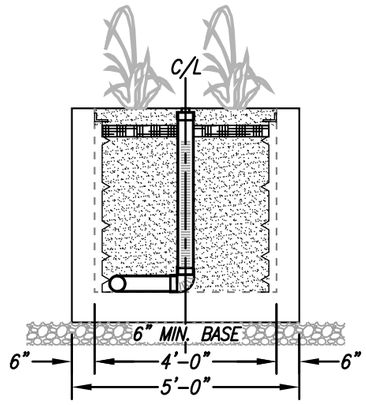
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER 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.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

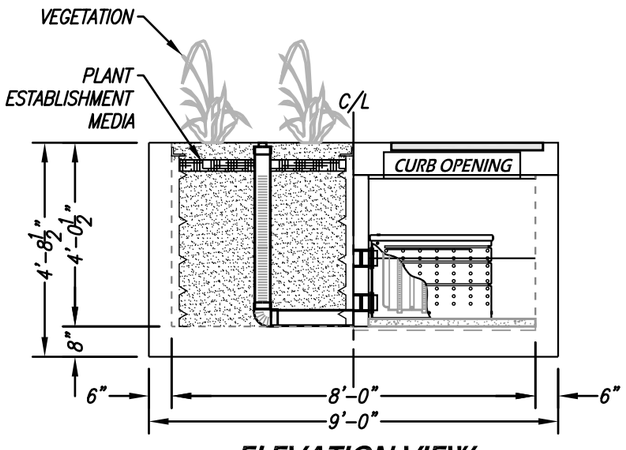
1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.



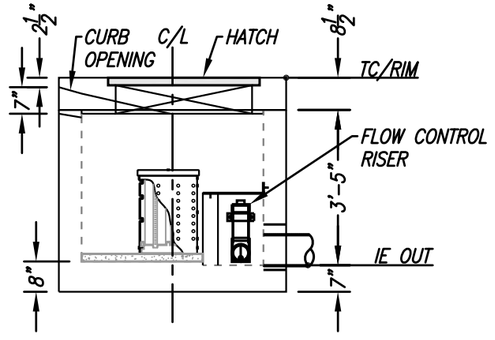
PLAN VIEW



LEFT END VIEW
BIOFILTRATION



ELEVATION VIEW



RIGHT END VIEW
PRETREATMENT/DISCHARGE

TREATMENT FLOW (CFS)	0.115
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-4-8-C
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

5/1/15/JOHN

SITE SPECIFIC DATA*	
PROJECT NAME	
PROJECT LOCATION	
STRUCTURE ID	

PERFORMANCE DATA	
TREATMENT VOLUME (CF)	
DRAINDOWN TIME (HR)	
TREATMENT HGL (FT)	
BYPASS FLOW RATE (CFS)	

PROJECT PARAMETERS			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
OUTLET PIPE 1			
RIM ELEVATION			
SURFACE LOADING REQUIREMENT			

FRAME & COVER	PRETREATMENT	BIOFILTRATION	DISCHARGE

WETLANDMEDIA VOLUME (CY)	
MEDIA DELIVERED	
ORIFICE SIZE (DIA)	
MAX PICK WEIGHT (LBS)	

NOTES:

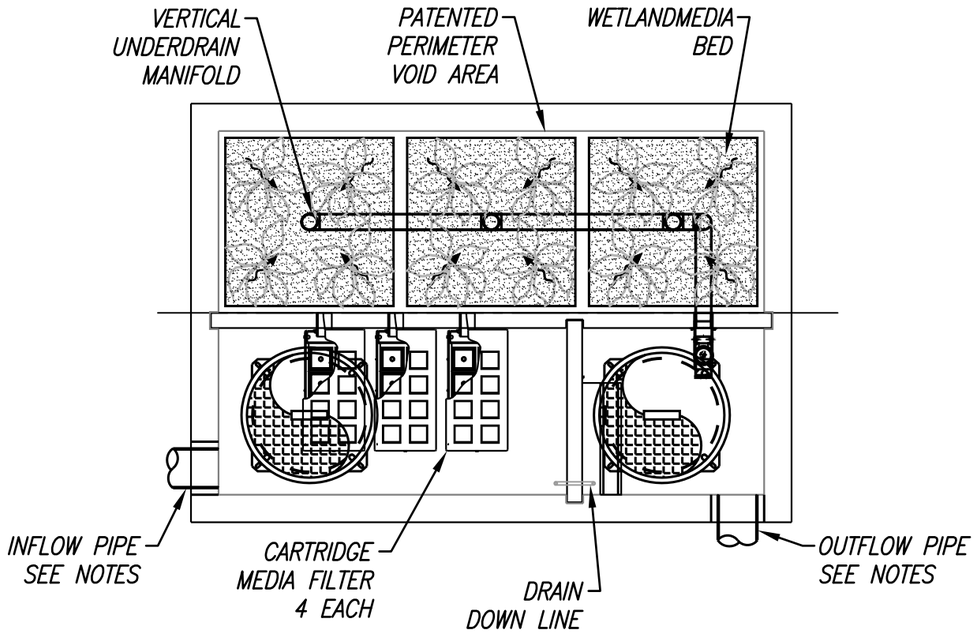
*PER ENGINEER OF RECORD

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. 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).
4. INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR.
5. 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.
6. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.

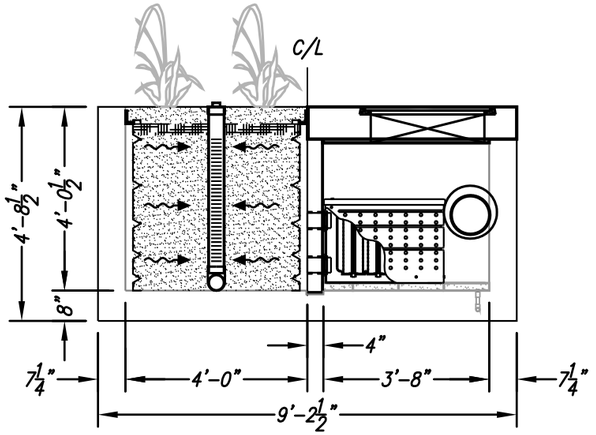
GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

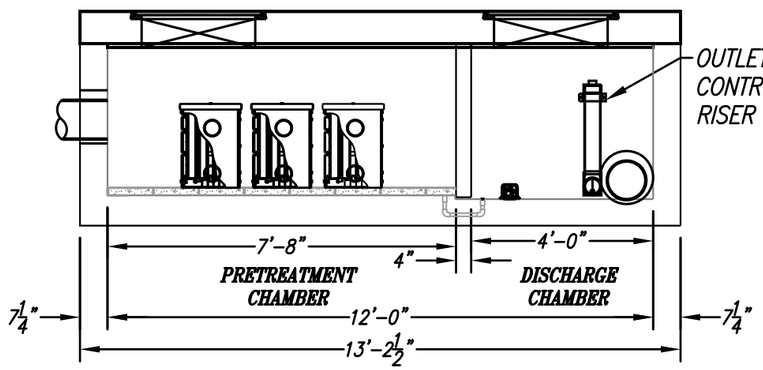


PLAN VIEW

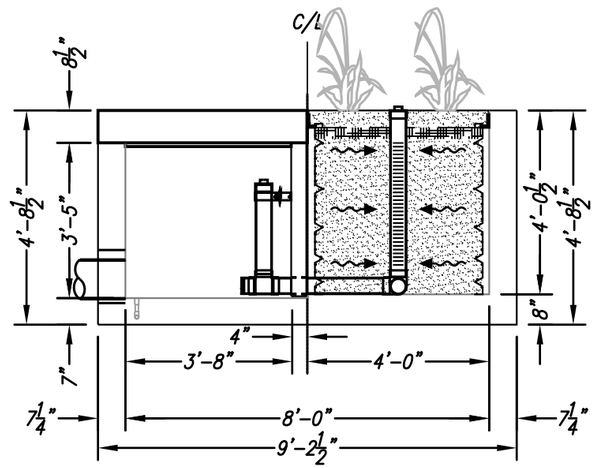
DMAs 1 & 7
Site-specific detail to be provided during final engineering



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

MWS UNIT DESIGN DATA	
TREATMENT CAPACITY (CFS)	0.346
OPERATING HEAD (FT)	3.4
PRETREATMENT SURFACE AREA (SF)	105.84
WETLAND LOADING RATE (GPM/MIN)	1.04

MODULAR WETLANDS

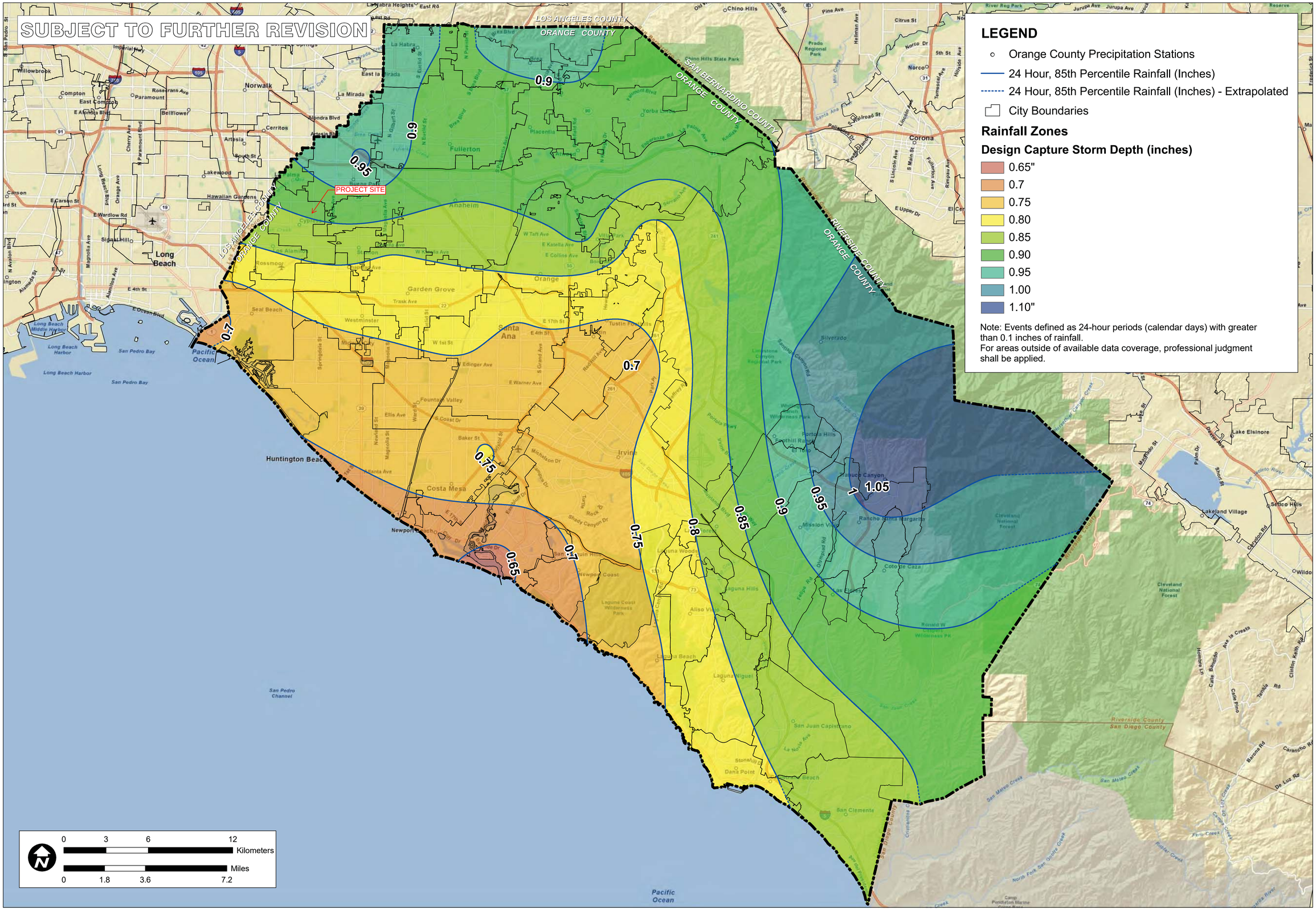
MWS-L-8-12-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

Worksheet J: Summary of Harvested Water Demand and Feasibility

1	What demands for harvested water exist in the tributary area (check all that apply):			
2	Toilet and urinal flushing		□	
3	Landscape irrigation		✓	
4	Other:_____		□	
5	What is the design capture storm depth? (Figure III.1)	d	0.90	inches
6	What is the project size?	A	6.34	ac
7	What is the acreage of impervious area?	IA	5.39	ac
	For projects with multiple types of demand (toilet flushing, irrigation demand, and/or other demand)			
8	What is the minimum use required for partial capture? (Table X.6)			gpd
9	What is the project estimated wet season total daily use (Section X.2)?			gpd
10	Is partial capture potentially feasible? (Line 9 > Line 8?)			
	For projects with only toilet flushing demand			
11	What is the minimum TUTIA for partial capture? (Table X.7)			
12	What is the project estimated TUTIA?			
13	Is partial capture potentially feasible? (Line 12 > Line 11?)			
	For projects with only irrigation demand			
14	What is the minimum irrigation area required based on conservation landscape design? (Table X.8) [5.39x1.01]		5.44	ac
15	What is the proposed project irrigated area? (multiply conservation landscaping by 1; multiply active turf by 2)		0.95	ac
16	Is partial capture potentially feasible? (Line 15 > Line 14?)		No	

Provide supporting assumptions and citations for controlling demand calculation:
Due to the proposed development type, density and amount of available landscaping, Harvest and Use BMPs for irrigation purposes will not be feasible.

SUBJECT TO FURTHER REVISION



LEGEND

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

Rainfall Zones

Design Capture Storm Depth (inches)

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

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

0 3 6 12 Kilometers
0 1.8 3.6 7.2 Miles

P:\19526E\16-GIS\Mxds\Reports\InfiltrationFeasability_20110215\19526E_FigureXVI-1_RainfallZones_20110215.mxd

TITLE: RAINFALL ZONES

ORANGE COUNTY
TECHNICAL GUIDANCE
DOCUMENT

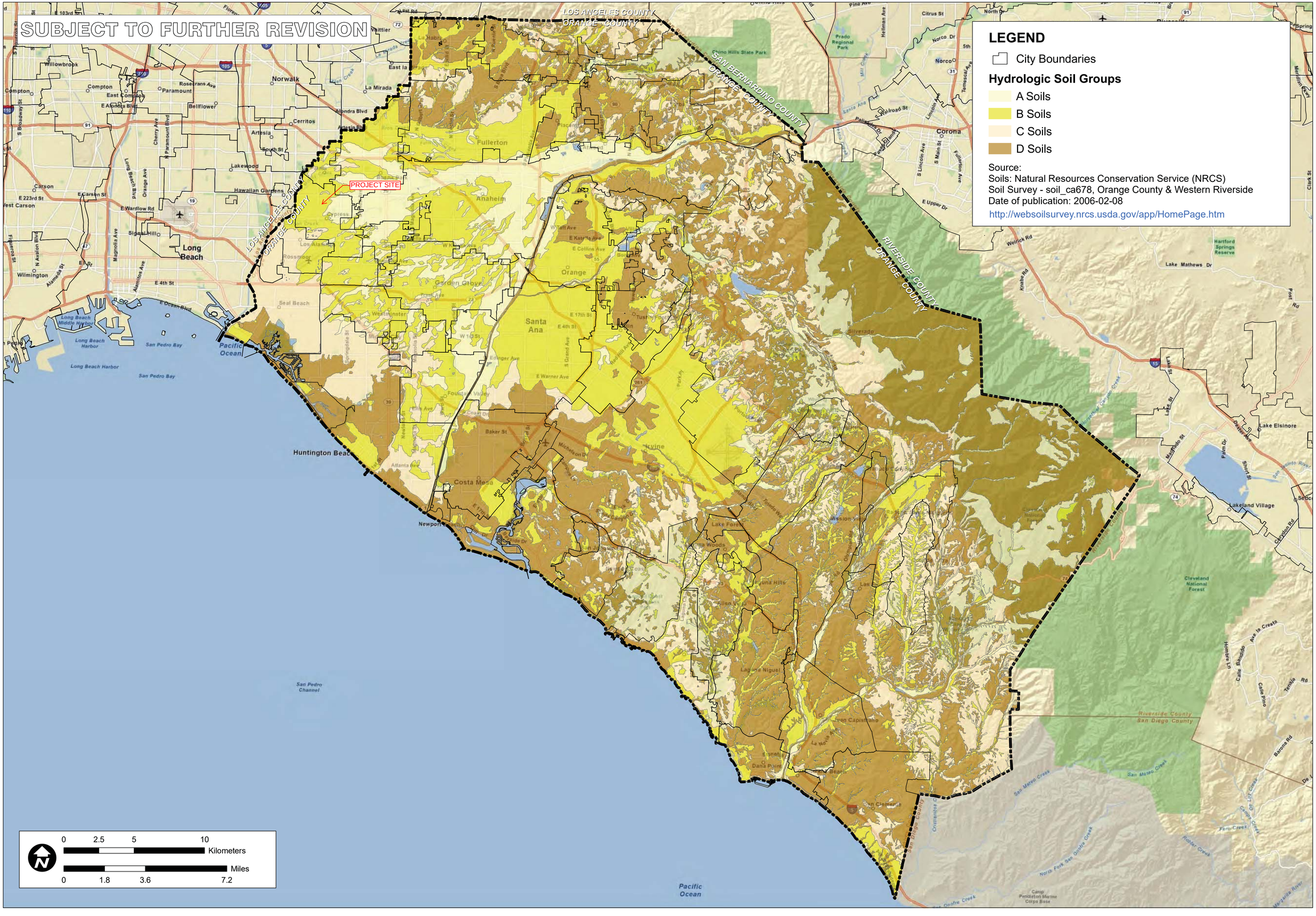
JOB: ORANGE CO. CA

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	19526-E

PACE
Advanced Water Engineering

FIGURE
XVI-1

SUBJECT TO FURTHER REVISION



LEGEND

City Boundaries

Hydrologic Soil Groups

- A Soils
- B Soils
- C Soils
- D Soils

Source:
Soils: Natural Resources Conservation Service (NRCS)
Soil Survey - soil_ca678, Orange County & Western Riverside
Date of publication: 2006-02-08
http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

TITLE
NRCS HYDROLOGIC SOILS GROUPS

JOB
ORANGE COUNTY INFILTRATION STUDY
ORANGE CO. CA

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

SUBJECT TO FURTHER REVISION

LEGEND

- Depth To First Groundwater Contours
- City Boundaries
- OCWD Groundwater Basin Protection Boundary

Note: Data are not available for South Orange County at this time.

Source:
Sprotte, Fuller and Greenwood, 1980.
California Division of Mines and Geology;
California Geological Survey

LOS ANGELES COUNTY
ORANGE COUNTY

SAN BERNARDINO COUNTY
ORANGE COUNTY

RIVERSIDE COUNTY
ORANGE COUNTY

PROJECT SITE

0 2 4 8 Kilometers
0 1.25 2.5 5 Miles

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

SUBJECT TO FURTHER REVISION

LEGEND

- City Boundaries
- OCWD Groundwater Basin Protection Boundary

Plume Protection Boundaries

- North Basin Groundwater Protection Project
- South Basin Groundwater Protection Project
- El Toro Marine Base
- Tustin Marine Air Base
- Approximate Selenium Contamination Area

Note: Individual contamination sites are not plotted.
See State Water Resources Control Board Geotracker database (http://geotracker.waterboards.ca.gov),
Department of Toxic Substance Control Envirostor database (http://www.envirostor.dtsc.ca.gov) and other applicable sources for current listing of active contaminated sites.

Groundwater basin and plume protection boundaries for South Orange County are not shown on this exhibit at this time

PROJECT SITE

LOS ANGELES COUNTY
ORANGE COUNTY

SAN BERNARDINO COUNTY
ORANGE COUNTY

RIVERSIDE COUNTY
ORANGE COUNTY

0 2 4 8 Kilometers

0 1.25 2.5 5 Miles

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2f_NorthOCGroundwaterProtectionAreasStreetMap_20110215.mxd

TITLE
NORTH ORANGE COUNTY
GROUNDWATER PROTECTION
AREAS

ORANGE COUNTY
INFILTRATION STUDY

JOB
ORANGE CO.

SCALE	1" = 1.25 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	9526-E

CA

PACE
Advanced Water Engineering

FIGURE
XVI-2f

Susceptibility

Potential Areas of Erosion, Habitat, & Physical Structure Susceptibility

Channel Type

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

Tidel Influence

- <= Mean High Water Line (4.28')

Water Body

- Basin
- Lake
- Reservoir

Other Lands

- Airport/Military

Los Angeles County

Santa River Watershed

Anaheim Bay-Huntington Harbor Watershed

Newport Bay-Newport Coastal Streams Watershed

Humble Reservoir

Orange County

Valencia Reservoir

Fullerton Reservoir

Loftus Diversion Channel Desilting Basin

Brea Creek Reservoir

Fullerton Reservoir

Fullerton Reservoir

Hillcrest Park Reservoir

Fullerton Airport

Miller Retarding Basin

La Jolla Recharge Basin

Placentia Retarding Basin

Kraemer Basin

Raymond Retarding Basin

Gilbert Retarding Basin

Crescent Retarding Basin

PROJECT SITE

Channel in Retarding Basin

Cypress Retarding Basin

Rossmoor Retarding Basin

Los Alamitos Retarding Basin

Los Alamitos Naval Air Station

Seal Beach Naval Weapons Station

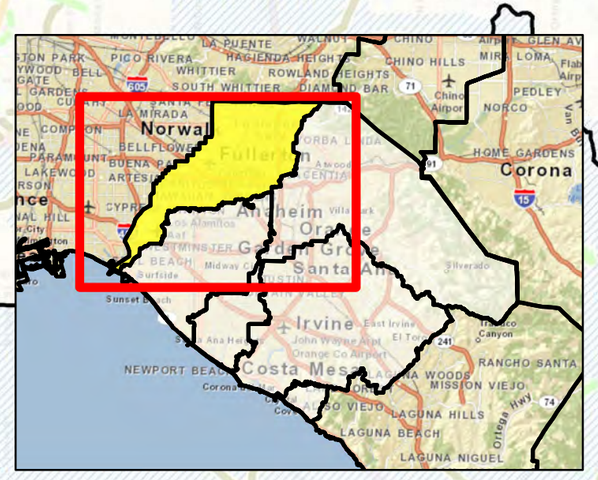
Fullerton

Anaheim

Buena Park

Seal Beach

Pacific Ocean



0 8,000 16,000 Feet

TITLE: SUSCEPTIBILITY ANALYIS SAN GABRIEL-COYOTE CREEK

ORANGE COUNTY WATERSHED MASTER PLANNING

JOB: ORANGE CO. CA

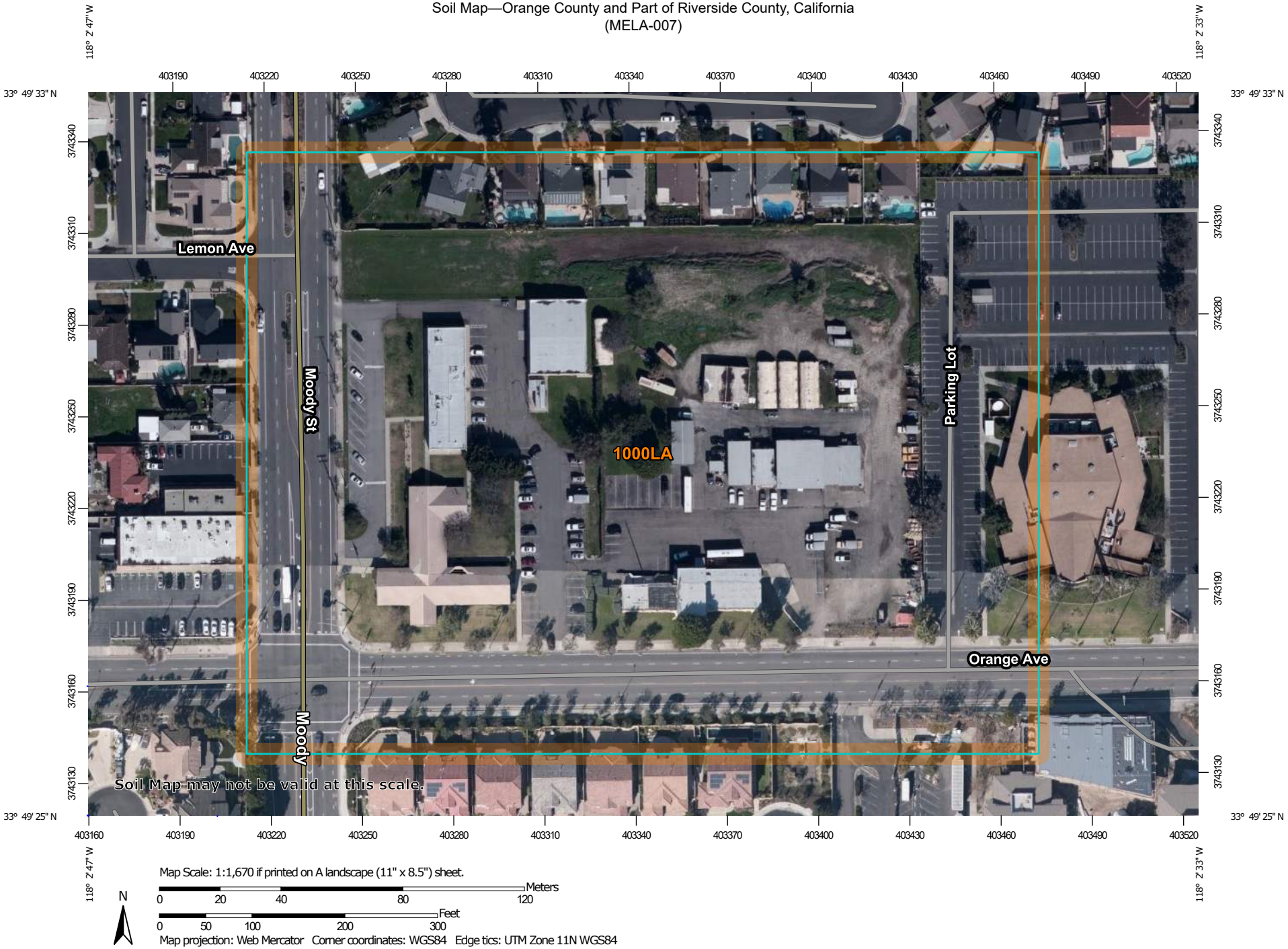
SCALE	1" = 8000'
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/30/10
JOB NO.	9526-E

PACE Advanced Water Engineering

1

P:\9526E\6-GIS\Mxds\SuceptabilityMaps_20100505\9526E_SanGabrielCoyoteCreekSusceptibility_20100430.mxd

Soil Map—Orange County and Part of Riverside County, California
(MELA-007)



Map Scale: 1:1,670 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 14, May 27, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 13, 2018—Feb 8, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1000LA	Urban land-Metz-Pico complex, 0 to 2 percent slopes	12.7	100.0%
Totals for Area of Interest		**12.7**	**100.0%**

Orange County and Part of Riverside County, California

1000LA—Urban land-Metz-Pico complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2mytv
Elevation: 10 to 560 feet
Mean annual precipitation: 13 to 19 inches
Mean annual air temperature: 64 to 66 degrees F
Frost-free period: 350 to 365 days

Map Unit Composition

Urban land: 45 percent
Metz and similar soils: 20 percent
Pico and similar soils: 15 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Flood plains

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Metz

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Discontinuous human-transported material over mixed alluvium derived from granite and/or sedimentary rock

Typical profile

A - 0 to 3 inches: loamy sand
C1 - 3 to 18 inches: loamy sand
C2 - 18 to 37 inches: sand
2C3 - 37 to 49 inches: silt loam
3C4 - 49 to 79 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: NoneRare
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Pico

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Discontinuous human-transported material over mixed alluvium derived from granite and/or sedimentary rock

Typical profile

A1 - 0 to 5 inches: loam
A2 - 5 to 18 inches: very fine sandy loam
AB - 18 to 47 inches: fine sandy loam
Bk - 47 to 79 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: NoneRare
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Corralitos
Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

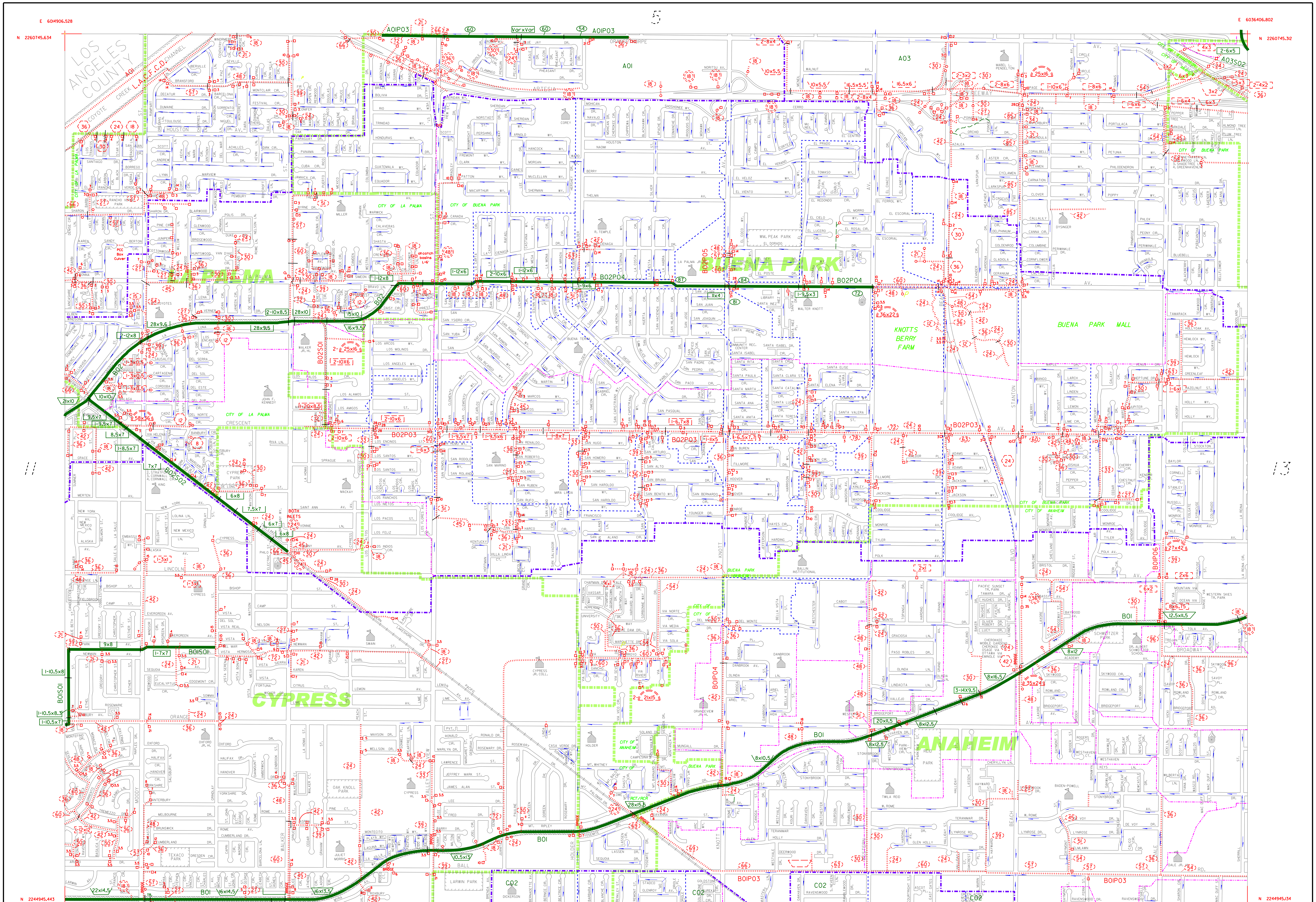
Hueneme, drained
Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

San emigdio
Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Xerorthents
Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 14, May 27, 2020



12

NOTICE

The drainage information has been prepared for information purposes only. The location, ownership, facility information and limits have been determined from available information provided by public agencies, but may not be exact, accurate, or up–to–date. The user of this information is responsible for verifying exact location, ownership, accuracy, and the regional versus local character of drainage facilities.

Additional information may be obtained from public plans and recorded deeds. Facility designations included with this information are for convenience only and are not controlling or intended to imply ownership by the County or the Orange County Flood Control District (OCFCD). The information is being provided as a courtesy and neither the County of Orange nor OCFCD assume any liabilities for inaccuracy of the information.

To notify OC Public Works Flood Control Section of additions or corrections, please contact Sal Gutierrez at (714) 647–3992 or by email at sal.gutierrez@ocpw.ocgov.com

ORANGE COUNTY FLOOD CONTROL DISTRICT

BASE MAP OF DRAINAGE FACILITIES IN ORANGE COUNTY

REVISION	DATE	SHEET NO.	DWG. NO.
S. GUTIERREZ	APR 23, 2012	12	MAPS–113–3

Channel Drainage Area Boundary
Major Sub–Area Drainage Boundary
Minor Sub–Area Drainage Boundary
Existing O.C.F.C.D. Facility
Existing Local Facility
Existing Retarding Basin or Reservoir
Natural Watercourse
City Limits
G G Greenbelt
P.S. P.S. Pump Station
Catch Basin (length in feet)
Drop Inlet or Other Entry
OCFCD Basins or Reservoirs

Ownership (If other than City or County): Private = P State = S Federal = F

EXISTING FACILITIES

O.C.F.C.D. LOCAL

Earth Trapezoidal Channel (base width by height in feet)
Reinforced Concrete Trapezoidal Channel (base width by height in feet)
Reinforced Concrete Rectangular Channel (base width by height in feet)
Reinforced Concrete Box (RCB) (number of barrels–span by height in feet)
Reinforced Concrete Pipe (RCP) (diameter in inches)
Metal Sheet Channel (MSC) (Base width by pile height in feet/Sheet pile total length)
Corrugated Metal Pipe (CMP) (diameter in inches)
Concrete Pipe (diameter in inches)
Concrete Oval Pipe (width by height in inches)
Steel Pipe (diameter in inches)
Reinforced Concrete Arch (base span by height in inches)
Corrugated Metal Arch (base span by height in inches)

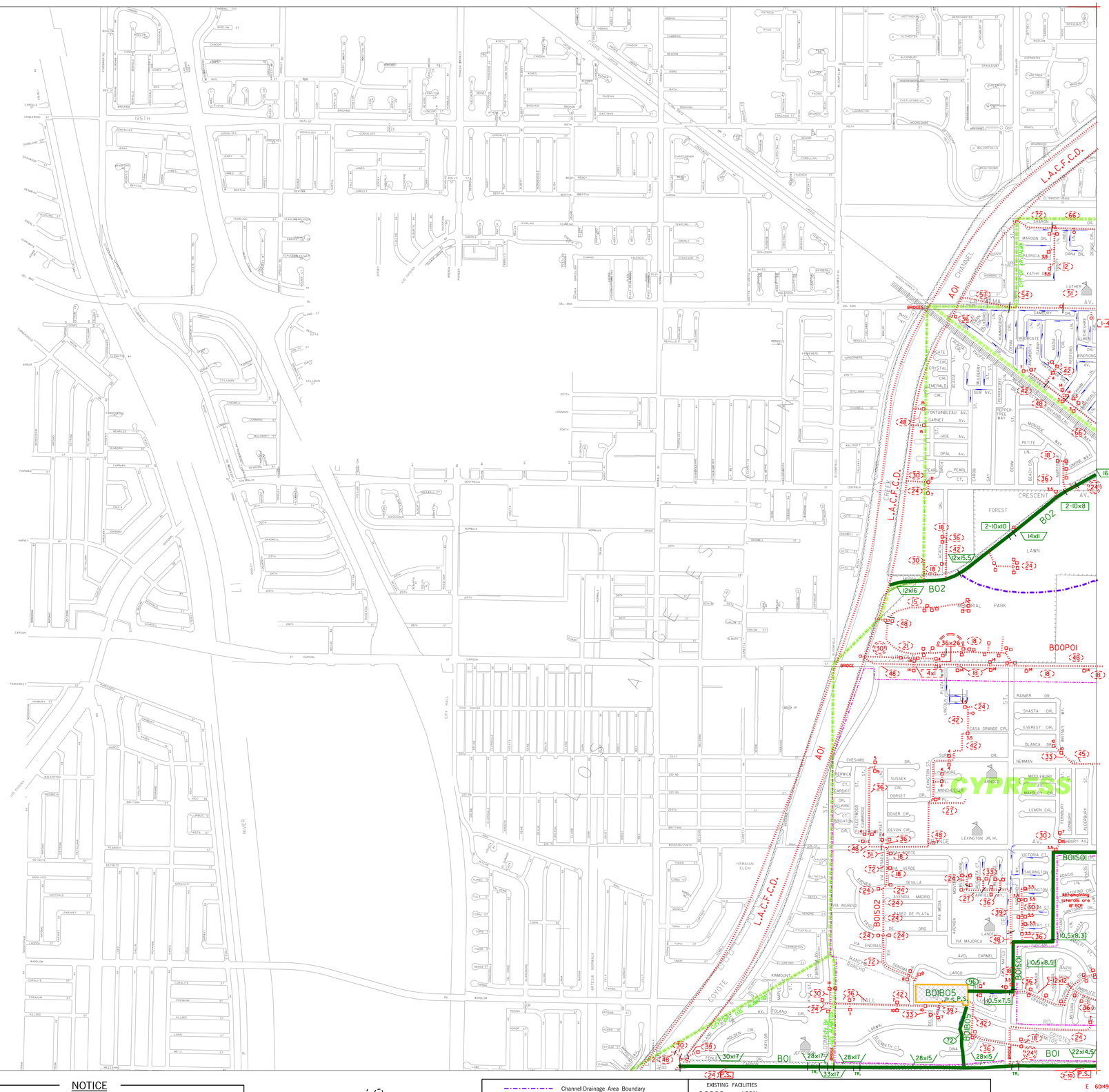
12

E 5993406.222

N 2260746.069

E 6014906.528

N 2260745.634



N 2244945.876

E 5993406.320

N 2244945.443

E 6014906.665

12

13

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ORANGE COUNTY FLOOD CONTROL DISTRICT

BASE MAP OF DRAINAGE FACILITIES IN ORANGE COUNTY

REVISION	DATE	SHEET NO.	DWG. NO.
S. GUTIERREZ	OCT. 1, 2007	II	MAPS-113-3

- Channel Drainage Area Boundary
- Major Sub-Area Drainage Boundary
- Minor Sub-Area Drainage Boundary
- Existing O.C.F.C.D. Facility
- Existing Local Facility
- Existing Retarding Basin or Reservoir
- Natural Watercourse
- City Limits
- G G Greenbelt
- P.S. P.S. Pump Station
- Catch Basin (length in feet)
- Drop Inlet or Other Entry
- OCFCD Basins or Reservoirs

Ownership (If other than City or County): Private = P State = S Federal = F

EXISTING FACILITIES

O.C.F.C.D.	LOCAL	
		Earth Trapezoidal Channel (base width by height in feet)
		Reinforced Concrete Trapezoidal Channel (base width by height in feet)
		Reinforced Concrete Rectangular Channel (base width by height in feet)
		Reinforced Concrete Box (RCB) (number of barrels-span by height in feet)
		Reinforced Concrete Pipe (RCP) (diameter in inches)
		Metal Sheet Channel (MSC) (Base width by pile height in feet.Sheet pile total length)
		Corrugated Metal Pipe (CMP) (diameter in inches)
		Concrete Pipe (diameter in inches)
		Concrete Oval Pipe (width by height in inches)
		Steel Pipe (diameter in inches)
		Reinforced Concrete Arch (base span by height in inches)
		Corrugated Metal Arch (base span by height in inches)

N

0 200 400 600 800

FEET

ATTACHMENT C

Site BMPs

SITE SPECIFIC DATA			
PROJECT 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	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	36" x 36"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			2.37
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.22"
MAXIMUM PICK WEIGHT (LBS)			16500
NOTES:			

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.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

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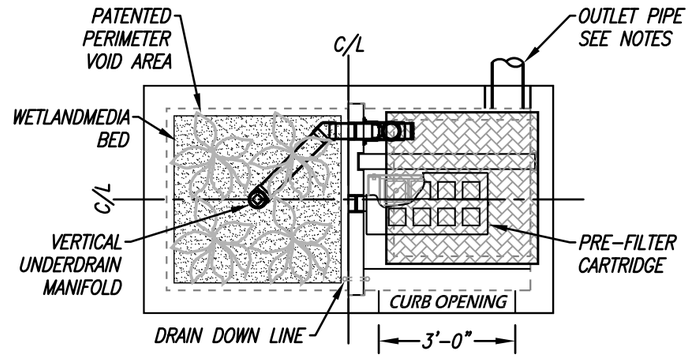
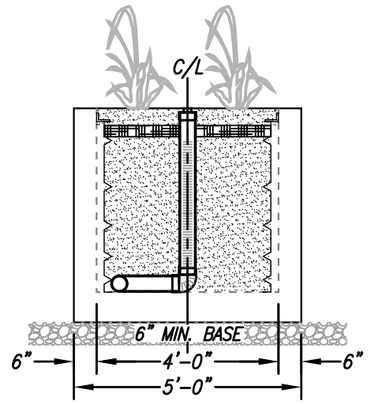
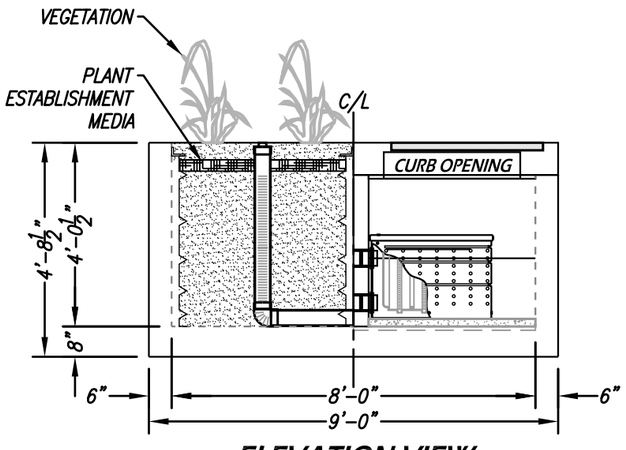


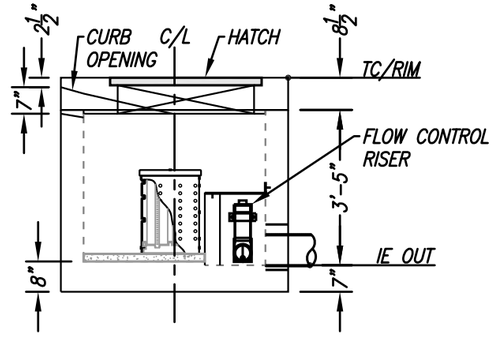
PLAN VIEW



LEFT END VIEW
BIOFILTRATION



ELEVATION VIEW



RIGHT END VIEW
PRETREATMENT/DISCHARGE

TREATMENT FLOW (CFS)	0.115
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-4-8-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

5/1/15/JOHN

SITE SPECIFIC DATA*	
PROJECT NAME	
PROJECT LOCATION	
STRUCTURE ID	

PERFORMANCE DATA	
TREATMENT VOLUME (CF)	
DRAINDOWN TIME (HR)	
TREATMENT HGL (FT)	
BYPASS FLOW RATE (CFS)	

PROJECT PARAMETERS			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
OUTLET PIPE 1			
RIM ELEVATION			
SURFACE LOADING REQUIREMENT			

FRAME & COVER	PRETREATMENT	BIOFILTRATION	DISCHARGE

WETLANDMEDIA VOLUME (CY)	
MEDIA DELIVERED	
ORIFICE SIZE (DIA)	
MAX PICK WEIGHT (LBS)	

NOTES:

*PER ENGINEER OF RECORD

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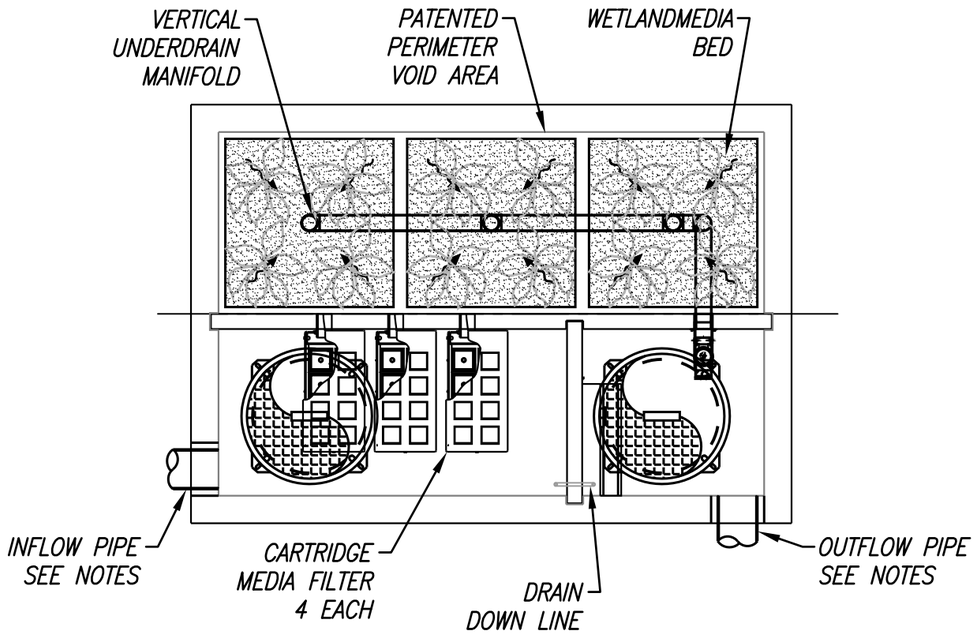
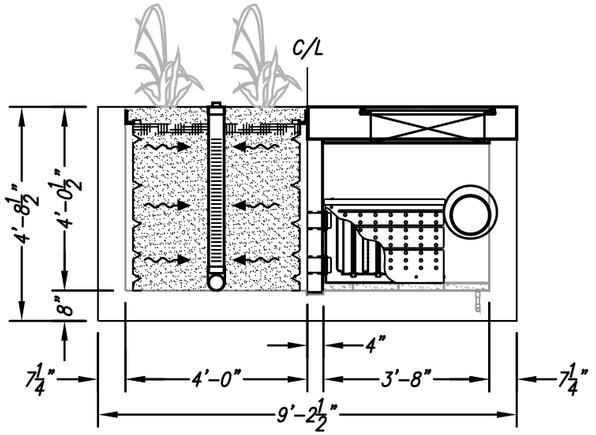
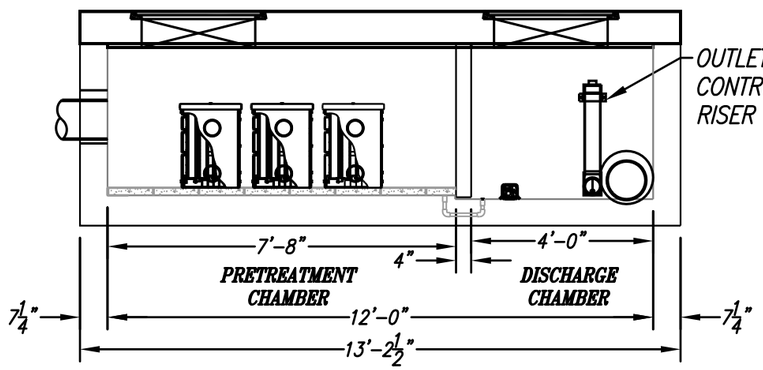


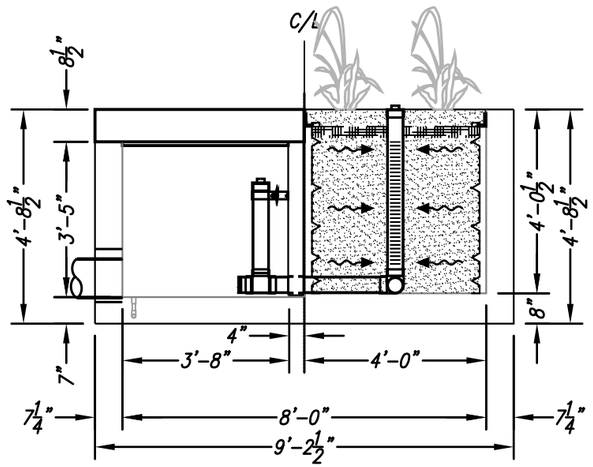
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

MWS UNIT DESIGN DATA	
TREATMENT CAPACITY (CFS)	0.346
OPERATING HEAD (FT)	3.4
PRETREATMENT SURFACE AREA (SF)	105.84
WETLAND LOADING RATE (GPM/MIN)	1.04

MODULAR WETLANDS

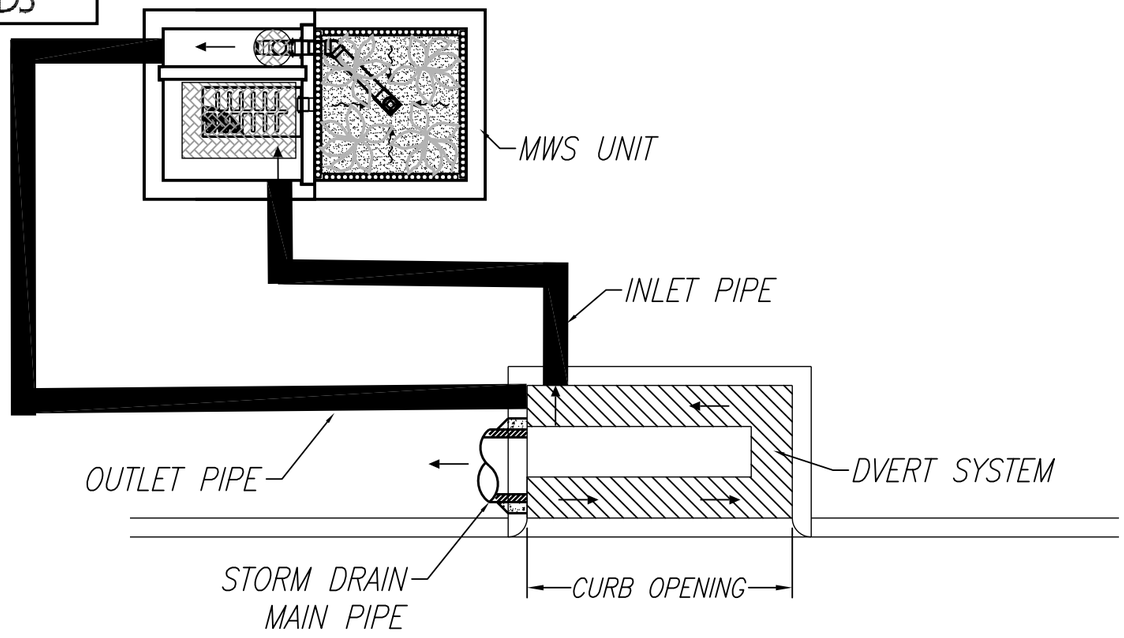
MWS-L-8-12-V

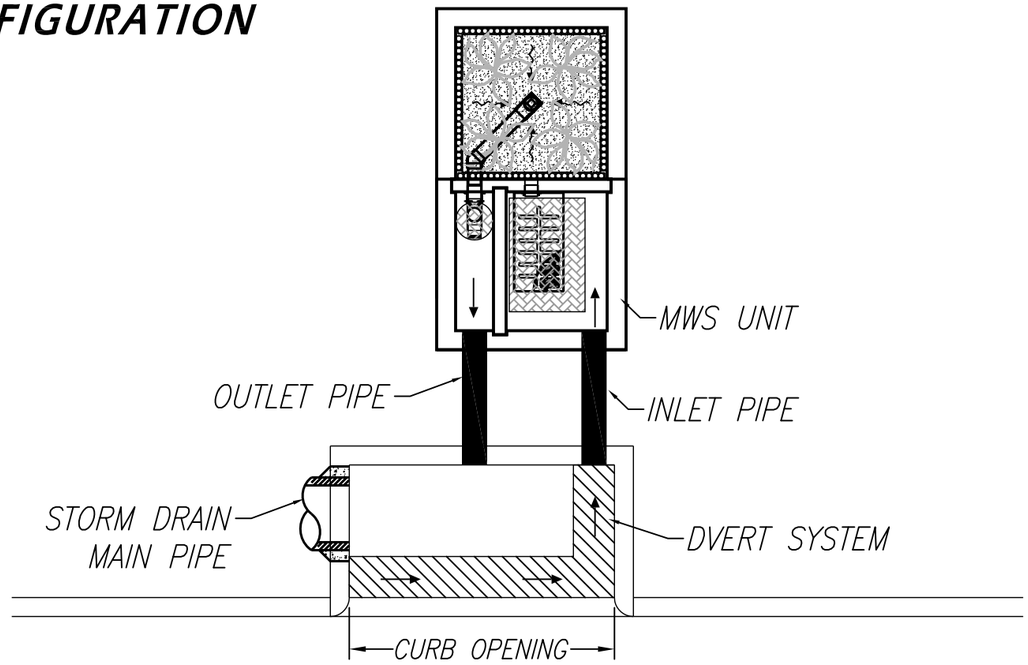
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

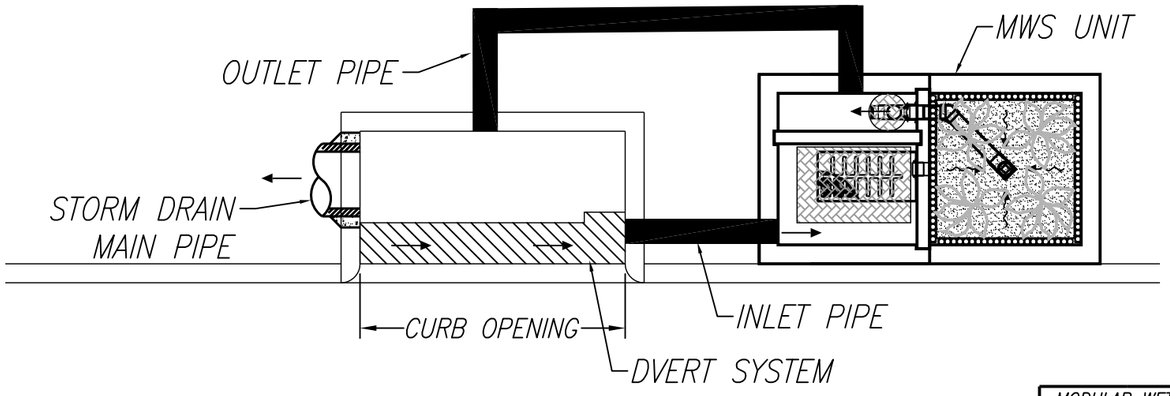
MWS Linear 2.0 HGL Sizing Calculations

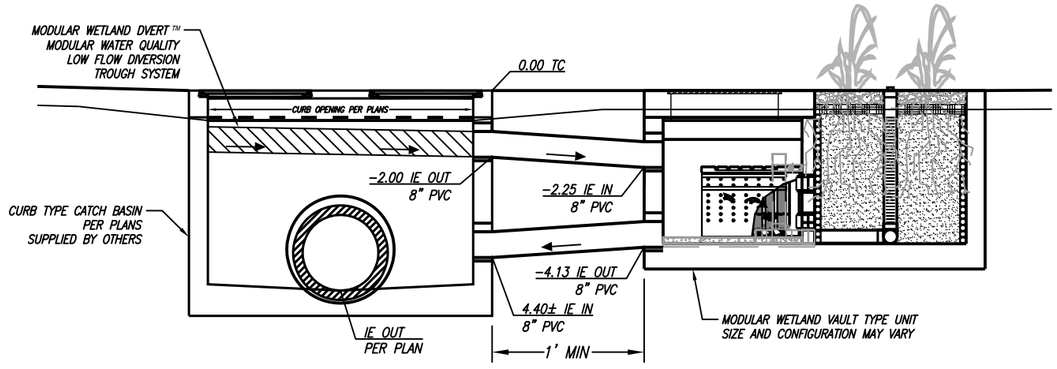
MWS MODEL SIZE	WETLAND PERMITER LENGTH	LOADING RATE GPM/SF	HGL HEIGHT																												
			SHALLOW MODELS																			STANDARD HEIGHT MODEL	HIGH CAPACITY MODELS									
			1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.65	3.70	3.75	3.80	3.85	3.90	3.95
MWS-L-4-4	6.70	1.0	0.022	0.023	0.025	0.026	0.028	0.029	0.031	0.032	0.034	0.035	0.037	0.038	0.040	0.042	0.043	0.045	0.046	0.048	0.049	0.051	**0.052**	0.054	0.055	0.056	0.057	0.058	0.058	0.059	0.060	0.061
~~**MWS-L-4-6**~~	~~10.00~~	~~1.0~~	~~0.032~~	~~0.035~~	~~0.037~~	~~0.039~~	~~0.042~~	~~0.044~~	~~0.046~~	~~0.048~~	~~0.051~~	~~0.053~~	~~0.055~~	~~0.058~~	~~0.060~~	~~0.062~~	~~0.065~~	~~0.067~~	~~0.069~~	~~0.072~~	~~0.074~~	~~0.076~~	**0.078**	~~0.081~~	~~0.083~~	~~0.084~~	~~0.085~~	~~0.087~~	~~0.088~~	~~0.089~~	~~0.090~~	~~0.091~~
MWS-L-4-6	9.30	1.0	0.030	0.032	0.034	0.036	0.038	0.041	0.043	0.045	0.047	0.049	0.051	0.053	0.055	0.058	0.060	0.062	0.064	0.066	0.068	0.070	**0.073**	0.075	0.077	0.078	0.079	0.080	0.081	0.082	0.083	0.084
MWS-L-4-8	14.80	1.0	0.048	0.051	0.054	0.058	0.061	0.065	0.068	0.071	0.075	0.078	0.082	0.085	0.088	0.092	0.095	0.099	0.102	0.105	0.109	0.112	**0.115**	0.119	0.122	0.124	0.126	0.127	0.129	0.131	0.132	0.134
MWS-L-4-13	18.40	1.0	0.059	0.063	0.068	0.072	0.076	0.080	0.084	0.089	0.093	0.097	0.101	0.106	0.110	0.114	0.118	0.122	0.127	0.131	0.135	0.139	**0.144**	0.148	0.152	0.154	0.156	0.158	0.160	0.163	0.165	0.167
MWS-L-4-15	22.40	1.0	0.072	0.077	0.082	0.087	0.093	0.098	0.103	0.108	0.113	0.118	0.123	0.129	0.134	0.139	0.144	0.149	0.154	0.159	0.165	0.170	**0.175**	0.180	0.185	0.188	0.190	0.193	0.195	0.198	0.200	0.203
MWS-L-4-17	26.40	1.0	0.085	0.091	0.097	0.103	0.109	0.115	0.121	0.127	0.133	0.139	0.145	0.151	0.158	0.164	0.170	0.176	0.182	0.188	0.194	0.200	**0.206**	0.212	0.218	0.221	0.224	0.227	0.230	0.233	0.236	0.239
MWS-L-4-19	30.40	1.0	0.098	0.105	0.112	0.119	0.126	0.133	0.140	0.147	0.153	0.160	0.167	0.174	0.181	0.188	0.195	0.202	0.209	0.216	0.223	0.230	**0.237**	0.244	0.251	0.255	0.258	0.262	0.265	0.269	0.272	0.276
MWS-L-4-21	34.40	1.0	0.111	0.118	0.126	0.134	0.142	0.150	0.158	0.166	0.174	0.182	0.189	0.197	0.205	0.213	0.221	0.229	0.237	0.245	0.253	0.261	**0.268**	0.276	0.284	0.288	0.292	0.296	0.300	0.304	0.308	0.312
MWS-L-6-8	18.80	1.0	0.060	0.065	0.069	0.073	0.078	0.082	0.086	0.091	0.095	0.099	0.104	0.108	0.112	0.116	0.121	0.125	0.129	0.134	0.138	0.142	**0.147**	0.151	0.155	0.157	0.160	0.162	0.164	0.166	0.168	0.170
MWS-L-8-8	29.60	1.0	0.095	0.102	0.109	0.115	0.122	0.129	0.136	0.143	0.149	0.156	0.163	0.170	0.177	0.183	0.190	0.197	0.204	0.211	0.217	0.224	**0.231**	0.238	0.245	0.248	0.251	0.255	0.258	0.262	0.265	0.268
MWS-L-8-12	44.40	1.0	0.143	0.153	0.163	0.173	0.183	0.194	0.204	0.214	0.224	0.234	0.245	0.255	0.265	0.275	0.285	0.296	0.306	0.316	0.326	0.336	**0.346**	0.357	0.367	0.372	0.377	0.382	0.387	0.392	0.397	0.402
MWS-L-8-16	59.20	1.0	0.190	0.204	0.217	0.231	0.245	0.258	0.272	0.285	0.299	0.312	0.326	0.340	0.353	0.367	0.380	0.394	0.408	0.421	0.435	0.448	**0.462**	0.476	0.489	0.496	0.503	0.509	0.516	0.523	0.530	0.537
MWS-L-8-20	74.00	1.0	0.238	0.255	0.272	0.289	0.306	0.323	0.340	0.357	0.374	0.391	0.408	0.425	0.442	0.459	0.476	0.493	0.509	0.526	0.543	0.560	**0.577**	0.594	0.611	0.620	0.628	0.637	0.645	0.654	0.662	0.671
MWS-L-10-20 or MWS-L-8-24	88.80	1.0	0.285	0.306	0.326	0.346	0.367	0.387	0.408	0.428	0.448	0.469	0.489	0.509	0.530	0.550	0.571	0.591	0.611	0.632	0.652	0.673	**0.693**	0.713	0.734	0.744	0.754	0.764	0.774	0.785	0.795	0.805
4'x'4 media cage	14.80	1.0	0.048	0.051	0.054	0.058	0.061	0.065	0.068	0.071	0.075	0.078	0.082	0.085	0.088	0.092	0.095	0.099	0.102	0.105	0.109	0.112	**0.115**	0.119	0.122	0.124						

MODULAR WETLAND SYSTEMS - LINEAR 2.0
STANDARD DVERT CONFIGURATION









MODULAR WETLAND SYSTEMS INC.
P.O. BOX 869
OCEANSIDE, CA 92049
www.ModularWetlands.com

	NAME	DATE
DRAWN		
EDITED		

COMMENTS:

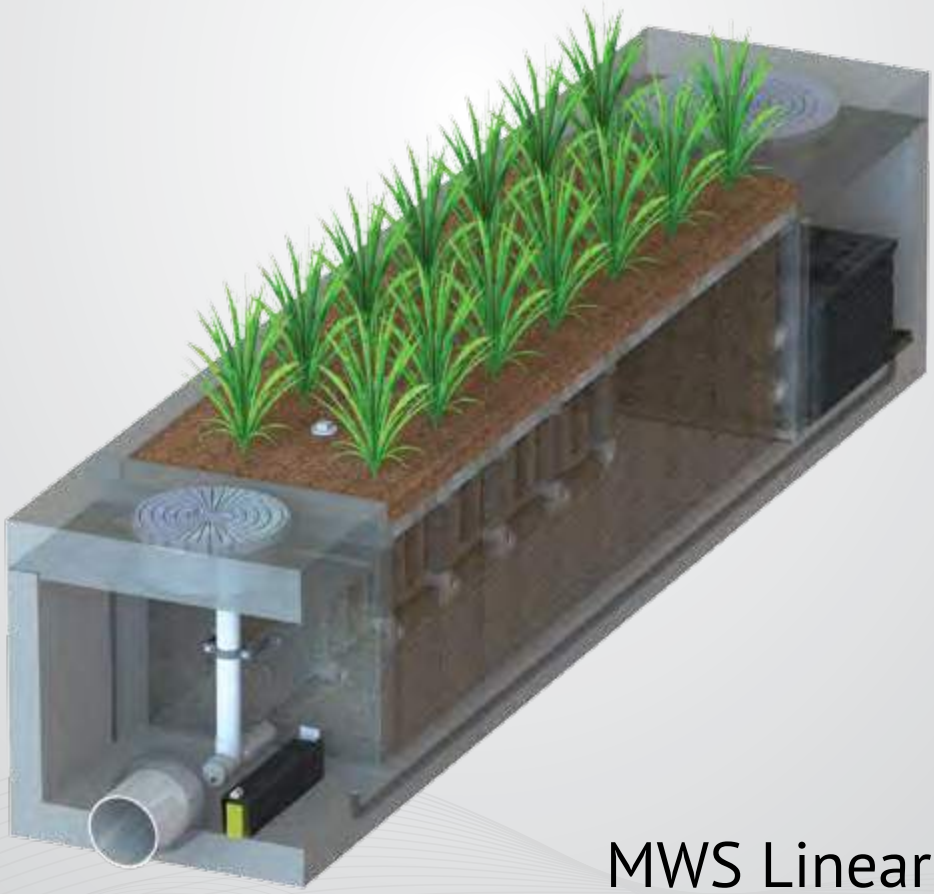
TITLE: MWS LINEAR 2.0 DVERT SETUP

SIZE	DWG. NO.	REV

SCALE NTS | UNITS = INCHES | SHEET 1 OF 1

MODULAR WETLANDS™

*Advanced **Stormwater** Biofiltration*



MWS Linear

Contents

The Urban Impact

For hundreds of years natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as our cities grow and develop, these natural wetlands have perished under countless roads, rooftops, and parking lots.

Plant A Wetland

Without natural wetlands our cities are deprived of water purification, flood control, and land stability. Modular Wetlands and the MWS Linear re-establish nature's presence and rejuvenate water ways in urban areas.

MWS Linear

The Modular Wetland System Linear represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity. While most biofilters use little or no pre-treatment, the MWS Linear incorporates an advanced pre-treatment chamber that includes separation and pre-filter cartridges. In this chamber sediment and hydrocarbons are removed from runoff before it enters the biofiltration chamber, in turn reducing maintenance costs and improving performance.

Applications

The MWS Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.

Industrial

Many states enforce strict regulations for discharges from industrial sites. The MWS Linear has helped various sites meet difficult EPA mandated effluent limits for dissolved metals and other pollutants.

Residential

Low to high density developments can benefit from the versatile design of the MWS Linear. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.

Streets

Street applications can be challenging due to limited space. The MWS Linear is very adaptable, and offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.

Parking Lots

Parking lots are designed to maximize space and the MWS Linear's 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.

Commercial

Compared to bioretention systems, the MWS Linear can treat far more area in less space - meeting treatment and volume control requirements.

Mixed Use

The MWS Linear can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications are available on our website: www.ModularWetlands.com/Applications

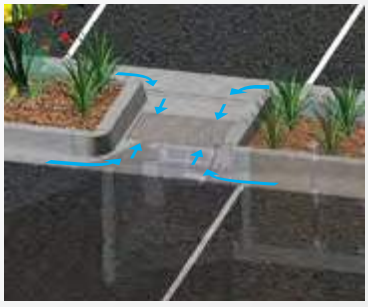
- Agriculture
- Reuse
- Low Impact Development
- Waste Water

Configurations

The MWS Linear is the preferred biofiltration system of Civil Engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your stormdrain design.

Curb Type

The *Curb Type* configuration accepts sheet flow through a curb opening and is commonly used along road ways and parking lots. It can be used in sump or flow by conditions. Length of curb opening varies based on model and size.



Grate Type

The *Grate Type* configuration offers the same features and benefits as the *Curb Type* but with a grated/drop inlet above the systems pre-treatment chamber. It has the added benefit of allowing for pedestrian access over the inlet. ADA compliant grates are available to assure easy and safe access. The *Grate Type* can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.

Vault Type

The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pre-treatment chamber, meaning the MWS Linear can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/bioretention systems. Another benefit of the "pipe in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.

Downspout Type

The *Downspout Type* is a variation of the *Vault Type* and is designed to accept a vertical downspout pipe from roof top and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

Advantages & Operation

The MWS Linear is the most efficient and versatile biofiltration system on the market, and the only system with horizontal flow which improves performance, reduces footprint, and minimizes maintenance. Figure-1 and Figure-2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.

Featured Advantages

- Horizontal Flow Biofiltration
- Greater Filter Surface Area
- Pre-Treatment Chamber
- Patented Perimeter Void Area
- Flow Control
- No Depressed Planter Area

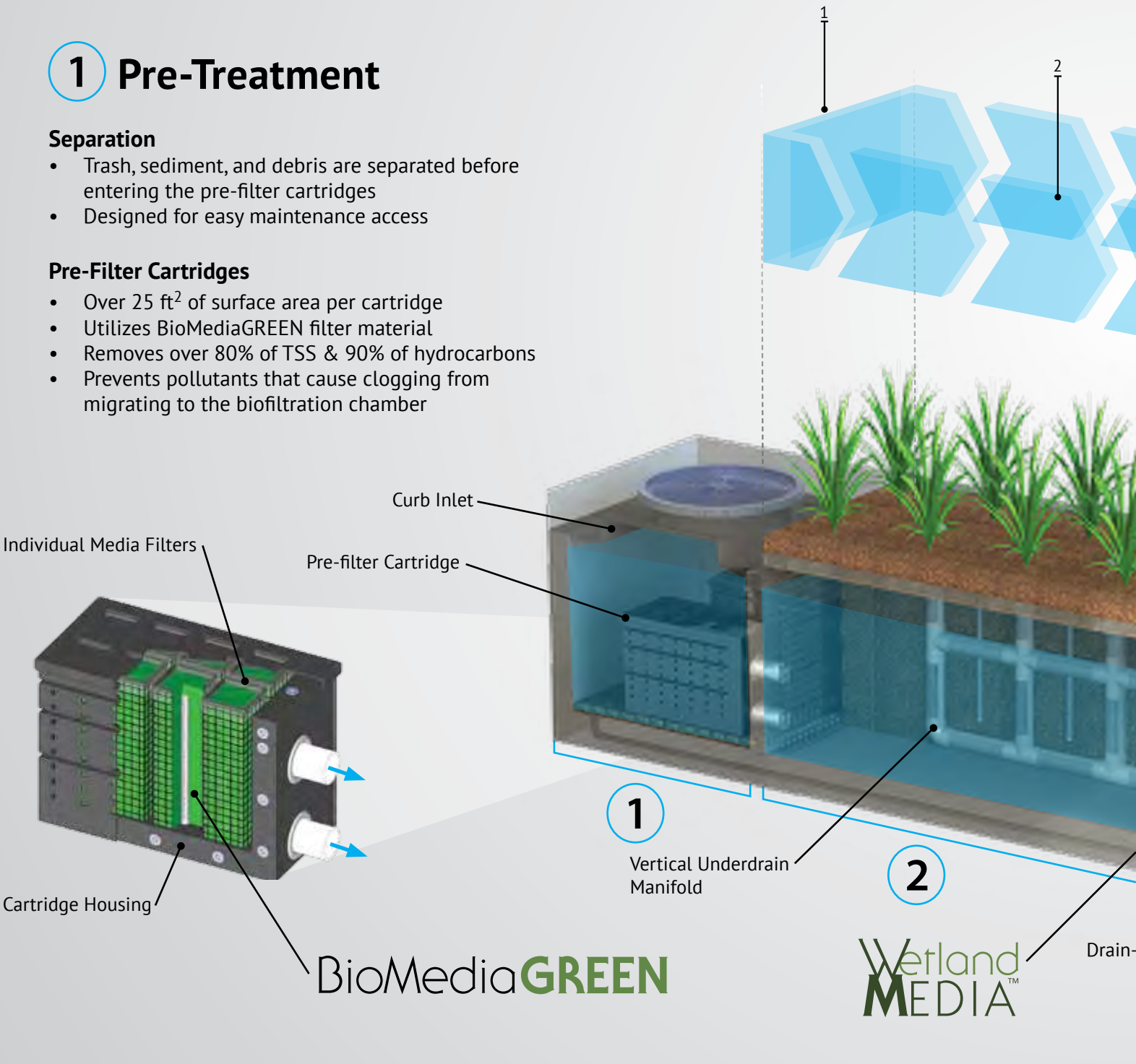
1 Pre-Treatment

Separation

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

Pre-Filter Cartridges

- Over 25 ft^2 of surface area per cartridge
- Utilizes BioMediaGREEN filter material
- Removes over 80% of TSS & 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber



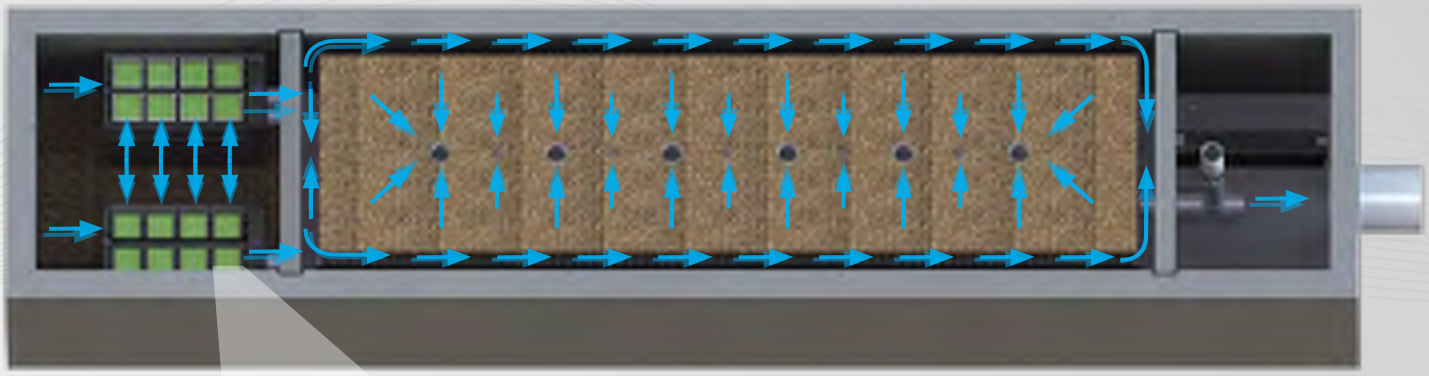


Fig. 2 - Top View

2x to 3x More Surface Area Than Traditional Downward Flow Bioretention Systems.

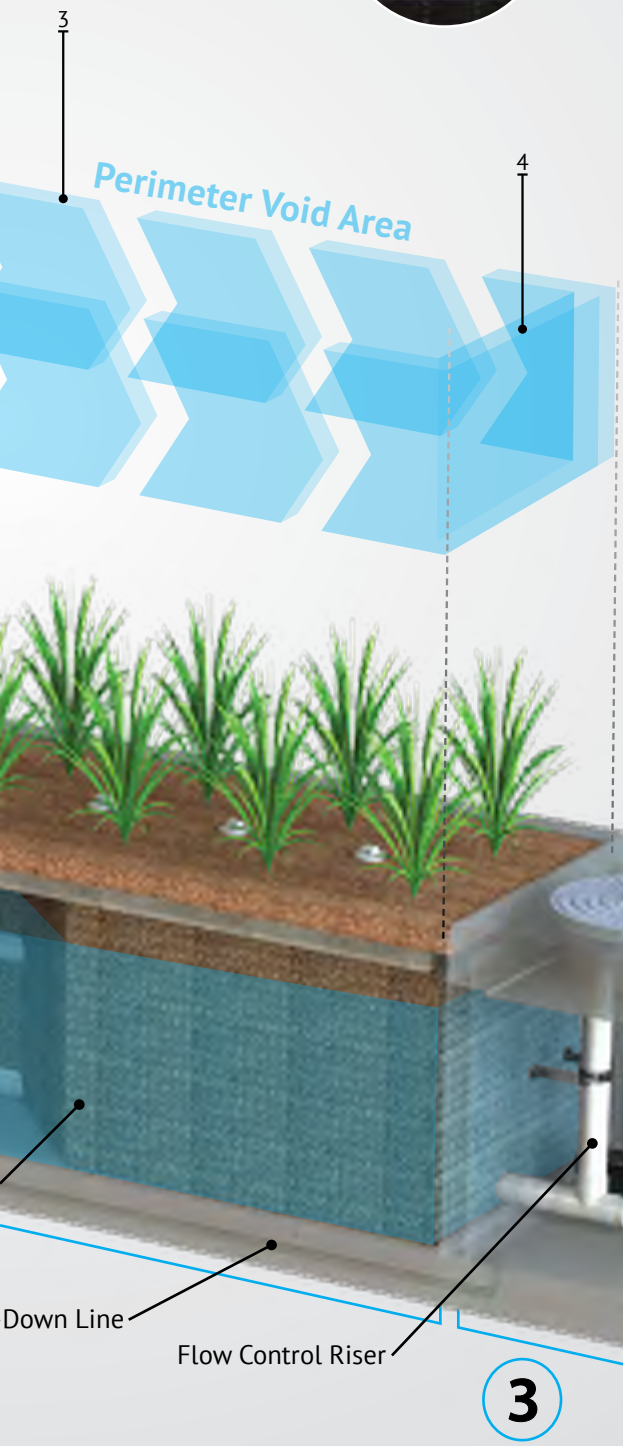


Fig. 1

2 Biofiltration

Horizontal Flow

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

Patented Perimeter Void Area

- Vertically extends void area between the walls and the WetlandMEDIA on all four sides.
- Maximizes surface area of the media for higher treatment capacity

WetlandMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and light weight

3 Discharge

Flow Control

- Orifice plate controls flow of water through WetlandMEDIA to a level lower than the media's capacity.
- Extends the life of the media and improves performance

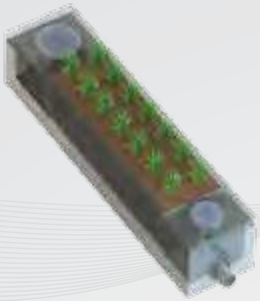
Drain-Down Filter

- The Drain-Down is an optional feature that completely drains the pre-treatment chamber
- Water that drains from the pre-treatment chamber between storm events will be treated

Orientations

Side-By-Side

The *Side-By-Side* orientation places the pre-treatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side. This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.



End-To-End

The *End-To-End* orientation places the pre-treatment and discharge chambers on opposite ends of the biofiltration chamber therefore minimizing the width of the system to 5 ft (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is bypass must be external.

Bypass

Internal Bypass Weir (Side-by-Side Only)

The *Side-By-Side* orientation places the pre-treatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pre-treatment chamber directly to the discharge chamber.

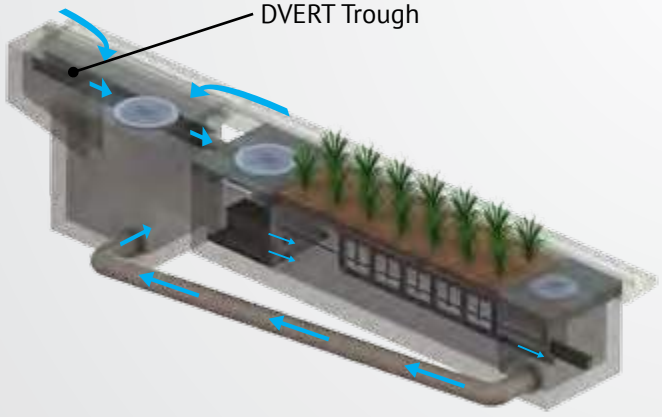
External Diversion Weir Structure

This traditional offline diversion method can be used with the MWS Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

Flow By Design

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

DVERT Low Flow Diversion



This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the MWS Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allows the MWS Linear to be installed anywhere space is available.

Performance

The MWS Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country. With it's advanced pre-treatment chamber and innovative horizontal flow biofilter, the system is able to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. With the same biological processes found in natural wetlands, the MWS Linear harnesses natures ability to process, transform, and remove even the most harmful pollutants.

Approvals

The MWS Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation, and perhaps the world.

Washington State DOE Approved

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft^2 loading rate. The highest performing BMP on the market for all main pollutant categories.

TSS	Total Phosphorus	Ortho Phosphorus	Nitrogen	Dissolved Zinc	Dissolved Copper	Total Zinc	Total Copper	Motor Oil
85%	64%	67%	45%	66%	38%	69%	50%	95%

DEQ Assignment

The Virginia Department of Environmental Quality assigned the MWS Linear, the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) Technical Criteria.

MASTEP Evaluation

The University of Massachusetts at Amherst – Water Resources Research Center, issued a technical evaluation report noting removal rates up to 84% TSS, 70% Total Phosphorus, 68.5% Total Zinc, and more.

Rhode Island DEM Approved

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% Pathogens, 30% Total Phosphorus for discharges to freshwater systems, and 30% Total Nitrogen for discharges to saltwater or tidal systems.

Flow Based Sizing

The MWS Linear can be used in stand alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

Treatment Flow Sizing Table

Model #	Dimensions	WetlandMedia Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4' x 4'	23 ft^2	0.052
MWS-L-4-6	4' x 6'	32 ft^2	0.073
MWS-L-4-8	4' x 8'	50 ft^2	0.115
MWS-L-4-13	4' x 13'	63 ft^2	0.144
MWS-L-4-15	4' x 15'	76 ft^2	0.175
MWS-L-4-17	4' x 17'	90 ft^2	0.206
MWS-L-4-19	4' x 19'	103 ft^2	0.237
MWS-L-4-21	4' x 21'	117 ft^2	0.268
MWS-L-8-8	8' x 8'	100 ft^2	0.230
MWS-L-8-12	8' x 12'	151 ft^2	0.346
MWS-L-8-16	8' x 16'	201 ft^2	0.462

Volume Based Sizing

Many states require treatment of a water quality volume and do not offer the option of flow based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume based design installed downstream of ponds, detention basins, and underground storage systems.

Treatment Volume Sizing Table

Model #	Treatment Capacity (cu. ft.) @ 24-Hour Drain Down	Treatment Capacity (cu. ft.) @ 48-Hour Drain Down
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145

Installation

The MWS Linear is simple, easy to install, and has a space efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles pre-cast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians are available to supervise installations and provide technical support.

Maintenance

Reduce your maintenance costs, man hours, and materials with the MWS Linear. Unlike other biofiltration systems that provide no pre-treatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pre-treatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pre-treatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pre-treatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long term operation and there is absolutely no need to replace expensive biofiltration media.

Plant Selection

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the MWS Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the MWS Linear, giving the plants more "contact time" so that pollutants are more successfully decomposed, volatilized and incorporated into the biomass of The MWS Linear's micro/macro flora and fauna.

A wide range of plants are suitable for use in the MWS Linear, but selections vary by location and climate. View suitable plants by selecting the list relative to your project location's hardy zone.

Please visit www.ModularWetlands.com/Plants for more information and various plant lists.

SPECIFICATIONS

MWS – Linear

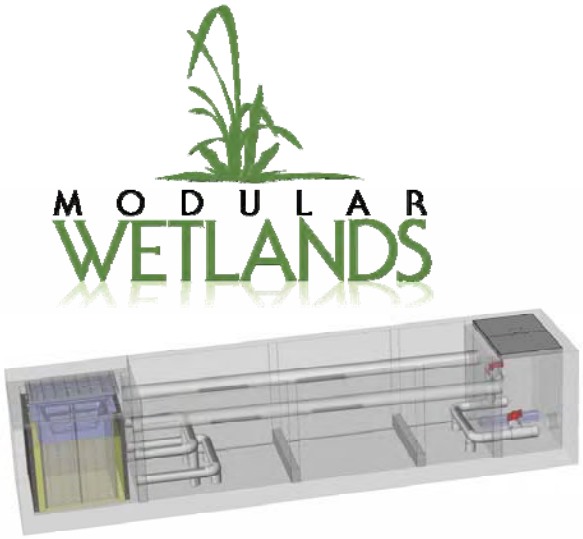
Hybrid Stormwater Filtration System

Modular Wetland Systems, Inc.
P.O. Box 869
Oceanside, CA 92049

www.modularwetlands.com
P 760-433-7640
F 760-433-3179

MWS – Linear

Hybrid Stormwater Filtration System



Save valuable space with small footprint for urban sites.

Improve BMP aesthetics with attractive native and tropical landscape plants.

Reduce lifetime costs with safer and less expensive maintenance

"The MWS – Linear hybrid stormwater treatment system is described as a self contained treatment train. This system utilizes an innovative combination of l treatment processes. Stormwater runoff flows into the system via pipe or curb/grate type catch basin opening. Polluted runoff first encounters a screening device to remove larger pollutants and then enters a hydrodynamic separation chamber which settles out the sediments and larger suspended solids. Next the runoff is treated by a revolutionary filter media, BioMediaGREEN that removes fines and associated pollutants, including bacteria. From there runoff enters of bioretention filter in the form of a subsurface flow vegetated gravel wetland. Within the wetland physical, chemical, and biological mechanisms remove the remaining particulate and dissolved pollutants. The purified runoff leaves the system via the discharge chamber. In the discharge chamber the rate of discharge is controlled by valves set to a desired rate".

Tested Pollutant Removal Efficiencies:

TSS Removal	Dissolved Lead Removal	Dissolved Copper Removal	TPH	E. coli Removal	Turbidity Removal
98%	81%	92%	99%	60.2%	92%

"Nature and Harmony Working Together in Perfect Harmony"

SPECIFICATIONS – MWS- LINEAR

Track Record: The MWS- Linear Hybrid Stormwater Treatment System is manufactured by a company whom is regularly engaged in the engineering design and production of treatment systems for stormwater.

Coverage: The MWS- Linear is designed to treat the water quality volume or water quality flow. For flow based design, high flow bypass is internal, for volume based design, high flow bypass is external and prior to pre-detention system. For offline volume based designs the MWS - Linear has the ability to treat the entire water quality volume when used with pre-storage and properly sized.

Non-Corrosive Materials: The MWS – Linear is designed with non-corrosive materials. All internal piping is SD35 PVC. Catch basin filter components, including mounting hardware, fasteners, support brackets, filtration material, and support frame are constructed of non-corrosive materials (316 stainless steel, and UV protected/marine grade fiberglass). Fasteners are stainless steel. Primary filter mesh is 316 stainless steel welded screens. Filtration basket screens for coarse, medium and fine filtration is ¾" x 1 ¾"expanded, 10 x 10 mesh, and 35 x 35 mesh, respectively. No polypropylene, monofilament netting or fabrics shall be used in this system. Media Protective Panels are constructed of UV protected/marine grade fiberglass. Mounts are constructed of stainless steel. BioMediaGREEN is an inert rock substrate and is non-corrosive. Perimeter filter structure is constructed of lightweight injection molded plastic. Mounting brackets are constructed of SD40 PVC and are mounted with 3/8" diameter stainless steel redheads. Drain down filter cover is constructed of UV protected/marine grade fiberglass and stainless steel hinge and mount.

Weight: Each complete unit weighs approximately 29,000 to 40,000 pounds and requires a boom crane to install. Details of this are provided in the installation section of the MWS-Linear Design Kit.

Transportation: The Modular Wetland System – Linear is designed to be transported on a standard flat bed truck. The unit easily fits on a flat bed truck without the need of special permitting.

Alternative Technology Configurations: The Modular Wetland System – Linear is modular is design. Each module will be up to 22 feet long and 5 feet wide. The system can be made in lengths varying from 13 to 100s of feet long. For lengths longer than 22 feet the system will shipped in modules and assembled on site. The Modular Wetland System – Linear has many alternative configurations. This allows the system to be adapted to many site conditions. Runoff can enter the system through a pipe, and/or a built in curb or grate type opening.

Energy Requirements: The Modular Wetland System – Linear is completely passive and requires no external energy sources.

Buoyancy Issues: Buoyancy is only a an issue when ground water levels rise above the bottom of the Modular Wetland System – Linear's concrete structure. With 8.5 cubic yards of wetland media there is no concern of floatation. As a precaution a footing can also be built into the systems concrete structure.

Durability: The structure of the box will be precast concrete. The concrete will be 28 day compressive strength fc = 5,000 psi. Steel reinforcing will be ASTM A – C857. Structure will support an H20 loading as indicted by AASHTO. The joint between the concrete sections will ship lap and joint sealed with ram-nek. Filter (excluding oil absorbent media) and support structures are of proven durability. The filter and mounting structures are of sufficient strength to support water, sediment, and debris loads when the filter is full, with no slippage, breaking, or tearing. All filters are warranted for a minimum of five (5) years.

Oil Absorbent Media: The MWS – Linear utilizes both physical and biological mechanisms to capture and filter oil and grease. A skimmer and boom system will be positioned on the internal perimeter of the catch basin insert. The primary filtration media, BioMediaGreen, utilized in the perimeter and drain down filters, has excellent hydrocarbon removal abilities. Within the wetland filter biological processes capture and

break down oil and grease. Much of the breakdown and transformation of oil and grease is performed by natural occurring bacteria.

Overflow Protection: The grate and curb type MWS – Linear are designed with an internal bypass consisting of two SD PVC pipes which direct high flows around the perimeter and wetland filter, directly into the discharge chamber. For the volume based vault type configuration, bypass should be located prior to the pre-detention system. For peak flows that exceed internal bypass capacity, external bypass is use.

Filter Bypass: Runoff will bypass filtration (BioMediaGREEN and wetland filter) components of the MWS - Linear. The system will still provide screening and settling during higher flow rates for internally bypassed flows. External bypass will bypass of treatment processes.

Pollutant Removal Efficiency: The MWS - Linear is capable of removing over 90% of the net annual total suspended solids (TSS) load based on a 20-micron particle size. Annual TSS removal efficiency models are based on documented removal efficiency performance from full-scale laboratory tests on BioMediaGreen and quarter-scale laboratory tests on the MWS – Linear flow based system.

POLLUTANT	REMOVAL EFFICIENCY
Trash & Litter	99%
TPH (mg/L)	99%
TSS (mg/L)	98%
E. Coli (MPN/100ml)	60%
Turbidity (NTU)	92%
Dissolved Metals (mg/L)	76%

Sil-Co-Sil 106. Mean particle diameter = 19 microns

Non-Scouring: During heavy storm events the runoff bypasses perimeter and wetland filter components. The system will not re-suspend solids at design flows.

Uniqueness: The Modular Wetland System – Linear is a complete self contained treatment train that incorporates capture, screening, sedimentation, filtration, bioretention, high flow bypass, and flow control into a single modular structure. This system provides four stages of treatment making it the only 4 stage treatment train stormwater filtration system, therefore making it unique to the industry. Other systems do not incorporate all the necessary attributes to make it a complete stormwater management device as with the Modular Wetland System – Linear. Therefore, no equal exists for this system.

Pretreatment & Preconditioning: Since the Modular Wetland System – Linear is a complete capture and treatment train stormwater management system no external pretreatment of preconditioning is necessary.

SPECIFICATIONS – BioMediaGREEN

BioMediaGREEN is a proprietary engineered filter media. Made of a unique combination of the inert naturally occurring material this product is non-combustible and do not pose a fire hazard, stable and non-reactive, and is also biodegradable. It is stable with no known adverse environmental effects.

This product has been tested in long-term carcinogenicity studies [inhalation and intraperitoneal injection (i.p.)] with no significant increase in lung tumors or abdominal tumors. Short-term biopersistent (inhalation and intra-tracheal injection) studies have shown that the products disappear very rapidly from the lung.

In October 2001, IARC classified this product as Group 3, "not classifiable as to its carcinogenicity to humans". The 2001 decision was based on the latest epidemiological studies and animal inhalation studies that show no relation between inhalation exposure and the development of tumors.

The product can typically be disposed of in an ordinary landfill (local regulations may apply). If you are unsure of the regulations, contact your local Public Health Department or the local office of the Environmental Protection Agency (EPA).

Coverage: When properly installed BioMediaGREEN Filter Blocks provide sufficient contact time, at rated flows, of passing contaminate water. The BioMediaGREEN material will capture and retain most pollutants that pass through it. The BioMediaGREEN material is made of a proprietary blend of inert substances. The BioMediaGREEN Filter Blocks can be used in different treatment devices, including but not limited to flume filters, trench drain filters, downspout filters, catch basin inserts, water polishing units, and hydrodynamic separators.

Non-Corrosive Materials: The BioMediaGreen material is made of non-corrosive materials.

Durability: The BioMediaGREEN material has been chosen for its proven durability, with an expected life of 2 plus years. The BioMediaGREEN material is of sufficient strength to support water, sediment, and debris loads when the media is at maximum flow; with no slippage, breaking, or tearing. The BioMediaGREEN material has been tested through rigorous flow and loading conditions.

Oil Absorbent Media: The BioMediaGREEN material has been proven to capture and retain hydrocarbons.

Pollutant Removal Efficiency: The BioMediaGREEN Filter Blocks are designed to capture high levels of Hydrocarbons including but not limited to oils & grease, gasoline, diesel, and PAHs. BioMediaGREEN Filter Blocks have the physical ability to block and filter trash and litter, grass and foliage, sediments, TSS, particulate and dissolved metals, nutrients, and bacteria.

BioMediaGREEN technology is based on a proprietary blend of synthetic inert natural substances aimed at removal of various stormwater pollutants. BioMediaGREEN was created to have a very porous structure capable of selectively removing pollutants while

allowing high flow through rates for water. As pollutants are captured by its structure, BioMediaGREEN captures most pollutants and maintains porosity and filtering capabilities.

Field and laboratory tests have confirmed the BioMediaGREEN capability to capture large percentage of TSS, hydrocarbons, nutrients, and heavy metals. Microbial reduction efficiency will vary depending on colony size, flow rates and site specific conditions.

POLLUTANT	REMOVAL EFFICIENCY
Oil & Grease (mg/L)	90%
TPH (mg/L)	99%
TSS (mg/L)	85%
Turbidity (NTU)	99%
Total Phosphorus (mg/L)	69.6%
Dissolved Metals (mg/L)	75.6%

Sil-Co-Sil 106. Mean particle diameter = 19 microns

Replacement: Removal and replacement of the blocks is simple. Remove blocks from filtration system. Replace with new block of equal size.

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)**.

In South Orange County, the provided ponding plus pore volume must be checked to demonstrate that it is greater than 0.75 of the remaining DCV that this BMP is designed to address. Many propretary biotreatment BMPs will not be able to meet the definition of "biofiltration" that applies in South Orange County. See Section III.7 and Worksheet SOC-1.

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**

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.

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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

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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.

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- 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

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– 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

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.

Design Objectives

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

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.

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- 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.

Street Sweeping and Vacuuming SE-7

Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.

- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.
- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

ATTACHMENT D

Operation & Maintenance Plan

Operations and Maintenance (O&M) Plan

Water Quality Management Plan
For

Citrus Square – Senior Community, TTM 19147
9470 Moody Street
Cypress, CA 90630

APN: 244-092-030

Owner/ Developer:

Melia Homes
8951 Research Drive, Suite 100
Irvine, CA 92618
Contact: Chad Brown, Vice President of Planning & Development
(949) 759-4367/ chad@melia-homes.com

Homeowner's Association (HOA)/ Property Management Company (PMC):

To be determined

Exhibit A, Operations and Maintenance Plan

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 and Maintenance Responsibility
Non-Structural Source Control BMPs			
Yes	**N1. Education for Property Owners, Tenants, and Occupants** This will be addressed through educational materials. All included materials provide ways of mitigating stormwater pollution in everyday activities associated with residents as well as employees of the property management company and their sub-contractors. Practical informational materials are provided to residents, occupants, or tenants to increase the public's understanding of stormwater quality, sources of pollutants, and what they can do to reduce pollutants in stormwater.	HOA/ PMC to provide educational materials, a copy of the approved WQMP and Operation & Maintenance Plan (O&M) to new property owners, tenants, occupants & employees, at time of hire, leasing and/ or home purchase.	HOA/ PMC
Yes	**N2. Activity Restriction** Rules or guidelines for developments are established within the appropriate documents which prohibit activities that can result in discharges of pollutants.	HOA/ PMC employees notified of activities that are prohibited by homeowners.	Restrictions identified in Employee Manual and reviewed yearly by employees.
Yes	**N3. Common Area Landscaped Management** Specific practices are followed and ongoing maintenance is conducted to minimize erosion and over-irrigation, conserve water, and reduce pesticide and fertilizer applications.	Professional landscape company to conduct maintenance of landscaping to meet current water efficiency and keep plants healthy and bio areas maintained with proper soil amendments. Regular maintenance once a week and monthly inspection to determine deficiencies	The HOA/ PMC will maintain or hire professionals to manage the upkeep of the project's landscaped areas.
Yes	**N4. BMP Maintenance** In order to ensure adequate and comprehensive BMP implementation, all responsible parties are identified for implementing all non-structural and structural BMPs, cleaning, inspection, and other maintenance activities are specified including responsible parties for conducting such activities.	A minimum 2 Inspections/ Cleanings per year per manufacturer's specifications prior to October 1st (before the rainy season)	HOA/ PMC to hire professional BMP maintenance company to conduct regular inspections, repairs, and cleaning per manufacturer's specifications.
Yes	**N10. Uniform Fire Code Implementation** HOA/ PMC to comply with fire regulations and keep informed of the latest rules and requirements.	Comply with annual fire inspections and maintain building and access per the latest fire codes.	HOA/ PMC
Yes	**N11. Common Area Litter Control** The proposed project will have various trash receptacles located near the common areas. Trash management and litter control	Once per week provide litter removal of site parking lot and landscape areas and to	HOA/ PMC

	procedures are specified within this report, including responsible parties, and implemented to reduce pollution of drainage water.	empty common area trash bins.	
Yes	**N12. Employee Training** Practical informational materials and/or training are provided to employees at the initial time of hiring by the HOA/ PMC to increase their understanding of stormwater quality, sources of pollutants, and their responsibility for reducing pollutants in stormwater.	The distribution of these materials will be the responsibility of the HOA/ PMC at the initial hiring of the employee.	HOA/ PMC
Yes	**N14. Common Area Catch Basin Inspection** In order to ensure adequate and comprehensive BMP implementation, all responsible parties are identified for implementing all non-structural and structural BMPs, cleaning, inspection, and other maintenance activities are specified including responsible parties for conducting such activities.	Inspection twice per month of common areas where catch basins are located within the surrounding area and remove any trash/ debris.	HOA/ PMC
Yes	**N15. Street Sweeping Private Streets and Parking Lots** Regular sweeping is conducted to reduce pollution of drainage water.	City's Street Sweeping Services or approved Private Company on a weekly basis	HOA/ PMC
Structural Source Control BMPs			
Yes	**S1. Provide Storm Drain System Stenciling and Signage** Catch Basin Stenciling and Signage will be placed on all on-site catch basins to the satisfaction of the City Engineer.	Inspect and repair as needed all onsite storm drain stencilling & signage. Inspection should occur at minimum twice per year.	HOA/ PMC
Yes	**S4. Use Efficient Irrigation Systems and Landscape Design** Site efficient irrigation and landscaping has been implemented by the project's landscape architect to the satisfaction of the City Engineer and Planning Department.	HOA/ PMC to provide maintenance of landscaping to meet current water efficiency standards and keep plants healthily. Regular maintenance once a week and monthly inspection to determine any water deficiencies.	The HOA/ PMC will maintain or hire professionals to manage the upkeep of the project's landscaped areas.
LID & Treatment Control BMPs			
Yes	**Treatment Control BMP** **Modular Wetlands System Biofiltration Vault & Dvert System** See attached for specific BMP detailed information pertaining to operation and maintenance.	Inspections/ Cleanings should occur at least two times per year and before the start of the rainy season (October 1st). Refer to Attachment C	HOA/ PMC will be required to hire a professional maintenance company to provide regular inspection, repairs and cleaning per manufacturer's

		for additional information and manufacturer's specifications.	specifications. All trash/ debris and loose sediment/ silt shall be removed per manufacturer's specifications.

Required Permits

This section must list any permits required for the implementation, operation, and maintenance of the BMPs. Possible examples are:

- No required permits are needed for the implementation, operation, and maintenance of the previously listed BMPs.

Forms to Record the BMP Implementation, Maintenance, and Inspection

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

Recordkeeping

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

Notice to Owner:

The property is currently owned by Melia Homes. The Owner will be responsible for the long-term maintenance of the project's storm water facilities and conformance to this WQMP after construction is complete.

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

RECORD OF BMP IMPLEMENTATION, MAINTENANCE, AND INSPECTION

Today's Date: _____

Name of Person Performing Activity: _____
(Printed)

Signature: _____

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

Operation & Maintenance Plan - Attachments

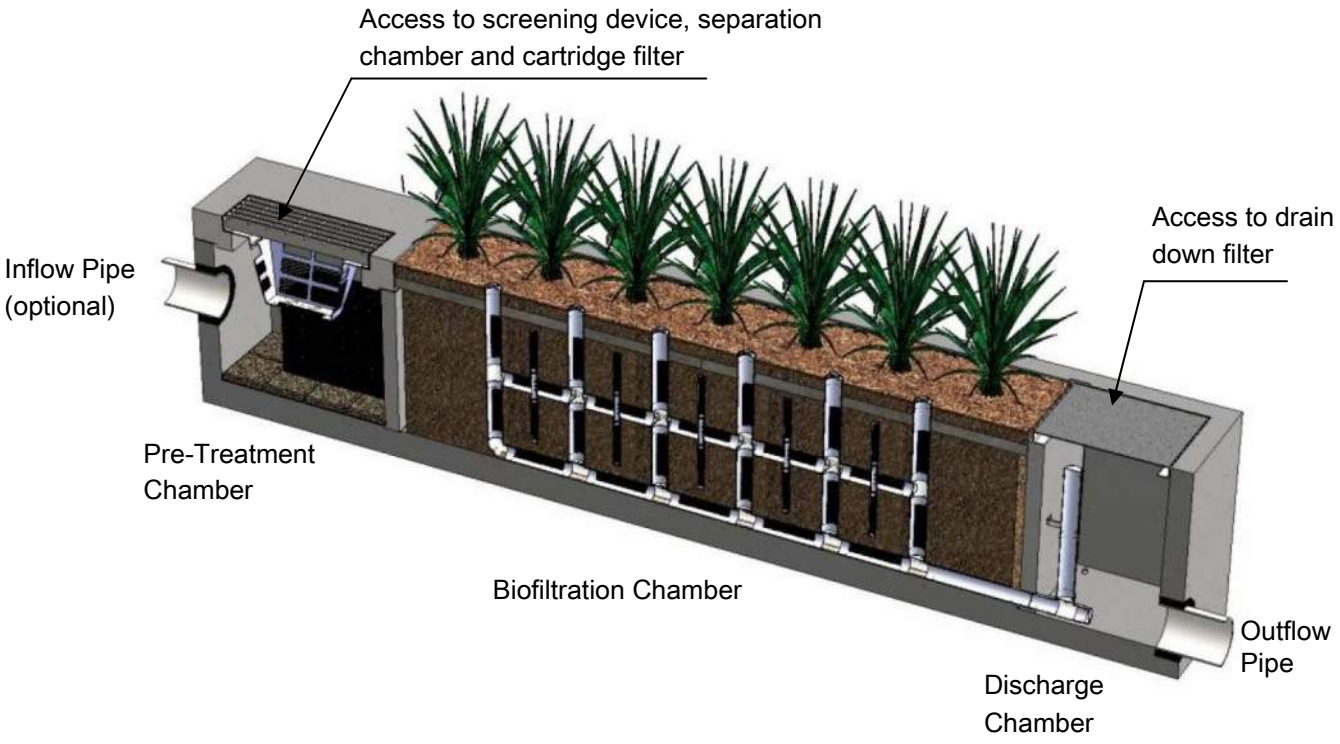
- Modular Wetlands System, Maintenance Guidelines

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 Report
Modular Wetlands System

Project Name _____

Project Address _____ (city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

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

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

Cleaning and Maintenance Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

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

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

Comments:

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

BioMediaGREEN

Modular Wetland System (MWS) – LINEAR

Maintenance Cost (per acre)

MWS - LINEAR	Cleaning Required	Yearly Maintenance Cost
Year 1	1) Clean Inlet Filter (6 Month Intervals) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media	$80 / each (x2) $350 / year $500 / year
Year 2	1) Clean Inlet Filter (6 Month Intervals) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media	$80 / each (x2) $350 / year $500 / year
Year 3	1) Clean Inlet Filter (6 Month Intervals) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media	$80 / each (x2) $350 / year $500 / year
Year 4	1) Clean Inlet Filter (6 Month Intervals) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media	$80 / each (x2) $350 / year $500 / year
Year 5	1) Clean Inlet Filter (6 Month Intervals) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media	$80 / each (x2) $350 / year $500 / year
Year 6	1) Clean Inlet Filter (6 Month Intervals) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media	$80 / each (x2) $350 / year $500 / year
Year 7	1) Clean Inlet Filter (6 Month Intervals) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media	$80 / each (x2) $350 / year $500 / year
Year 8	1) Clean Inlet Filter (6 Month Intervals) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media	$80 / each (x2) $350 / year $500 / year
Year 9	1) Clean Inlet Filter (6 Month Intervals) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media	$80 / each (x2) $350 / year $500 / year
Year 10	1) Clean Inlet Filter (6 Month Intervals) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media 4) Remove & Replace Wetland Plants & Media	$80 / each (x2) $350/ year $500 / year $2,500
Total 1 - 10	**Total Maintenance Cost Over 10 Years**	**$11,800**
Average Yearly Cost	**Assumes 10 Year Replacement of Wetland Media.**	**$1,180 / Year**

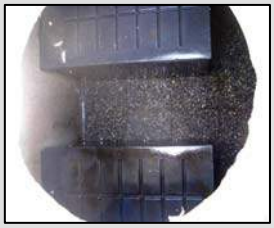
WWW.MODULARWETLANDS.COM

P: 760-433-7640

Modular Wetland System - Linear (MWS-Linear)

Maintenance Schedule

MWS - LINEAR	Cleaning Required	Est. Cleaning Time
Year 1	1) Clean Inlet Filter (6 Month Intervals) (does not apply to vault type) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media (12 month Intervals)	10 Minutes 25 Minutes 45 Minutes
Year 2	1) Clean Inlet Filter (6 Month Intervals) (does not apply to vault type) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media (12 month Intervals)	10 Minutes 25 Minutes 45 Minutes
Year 3	1) Clean Inlet Filter (6 Month Intervals) (does not apply to vault type) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media (12 month Intervals)	10 Minutes 25 Minutes 45 Minutes
Year 4	1) Clean Inlet Filter (6 Month Intervals) (does not apply to vault type) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media (12 month Intervals)	10 Minutes 25 Minutes 45 Minutes
Year 5	1) Clean Inlet Filter (6 Month Intervals) (does not apply to vault type) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media (12 month Intervals)	10 Minutes 25 Minutes 45 Minutes
Year 6	1) Clean Inlet Filter (6 Month Intervals) (does not apply to vault type) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media (12 month Intervals)	10 Minutes 25 Minutes 45 Minutes
Year 7	1) Clean Inlet Filter (6 Month Intervals) (does not apply to vault type) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media (12 month Intervals)	10 Minutes 25 Minutes 45 Minutes
Year 8	1) Clean Inlet Filter (6 Month Intervals) (does not apply to vault type) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media (12 month Intervals)	10 Minutes 25 Minutes 45 Minutes
Year 9…	1) Clean Inlet Filter (6 Month Intervals) (does not apply to vault type) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media (12 month Intervals)	10 Minutes 25 Minutes 45 Minutes
Year 15	1) Clean Inlet Filter (6 Month Intervals) (does not apply to vault type) 2) Vacuum Catch Basin (12 Month Intervals) 3) Replace BioMedia Green Filter Media (12 month Intervals) 4) Remove & Replace Wetland Plants & Media (every 10-20 years)	10 Minutes 25 Minutes 45 Minutes 6 to 8 Hours
Procedure 1 **Clean Inlet Filter** (does not apply to vault type) 	Modular Wetland Systems, Inc. recommends the catch basin filter be inspected and cleaned a minimum of once every six months and replacement of hydrocarbon booms once a year. The procedure is easily done with the use of any standard vacuum truck. Before doing maintenance please use proper safety and traffic control. 1) Remove grate or manhole, remove the deflector shield (grate type only). Note: entry into an underground stormwater vault such as an inlet vault requires certification in confined space training. 2) Remove all trash, debris, organics, and sediments collected by the inlet filter insert either manually or with the use of a vactor truck. 3) Evaluate hydrocarbon boom. If the boom is filled with hydrocarbons and oils it should be replaced. Attach new boom to basket with plastic ties through pre-drilled holes in basket. Place the deflector shield (grate type only) back into the filter. Hydrocarbon boom should be replaced annually. (The hydrocarbon boom may be classified as hazardous material and will have to be picked up and disposed of as hazardous waste).	**10 Minutes**

Procedure 2 **Vacuum Catch Basin** 	Modular Wetland Systems, Inc. recommends the separation chamber be inspected and cleaned a minimum of once a year. The procedure is easily done with the use of any standard vacuum truck. Before doing maintenance please use proper safety and traffic control. 1) Remove grate or manhole. 2) Remove catch basin filter. 3) Spray down pollutants accumulated on cartridge filters and catch basin walls. 4) Vacuum out sediments and debris accumulated on catch basin floor. 5) Replace catch basin filter, and replace grate or manhole cover.	**25 Minutes**
Procedure 3 **Replace BioMedia Green Media Filter**   	Modular Wetland Systems, Inc. recommends the BioMediaGREEN Cartridge Filters be inspected and cleaned a minimum of once a year. The procedure will require prior maintenance of catch basin. Before doing maintenance please use proper safety and traffic control. 1) Remove grate, remove catch basin filter. 2) Perform maintenance activities on catch basin. 3) Enter separation chamber, unscrew the two bolts holding the lid on the cartridge filter. This will expose the 14 pieces of BioMediaGREEN in each cartridge. 4) Evaluate media condition, replace if necessary. If the spaces between the media are filled with sediment and the surface of the media is dark brown or black the media should be replaced. The old media can be removed by hand by pulling the media pieces up out of the cartridge and taking them out of the catch basin. 5) Once all old media is removed, spray down the interior of the cartridge and vacuum out accumulated debris. 6) Use new pieces of BioMediaGREEN and slide down over the perforated PVC risers. The media will only go in one way for easy installation. Replace media over all risers. 5) Replace cartridge filter lid, replace catch basin filter, and replace grate or manhole cover. Modular Wetland Systems, Inc. recommends the drain down filter be inspected and maintained a minimum of once a year. 1) Open hatch of discharge chamber, enter chamber. 2) Unlatch fiberglass cover, remove media block, replace with new block, replace and latch cover. 3) Exit chamber, close and lock down the hatch. BioMediaGREEN	**45 Minutes**
Procedure 4 **Replace Wetland Media** 	Modular Wetland Systems, Inc. recommends the wetland media be evaluated every 3 to 5 years to test flow rate. The media life is approximately 15 to 20 years. The wetland media is an expanded shale that can be ordered from the manufacturer or independent supplier. If the flow through the wetland filter is decreasing the internal inflow and outflow pipes leading to and from the wetland chamber can be jetted. If the flow through the wetland is still minimal then the media may need to be replaced. To replace the media the following steps are required. Before doing maintenance please use proper safety and traffic control. 1) Remove plants and dispose. Have new plants standing ready to plant. 2) Use a larger vacuum truck to remove the media from the wetland chamber. 3) Spray down the chamber walls and remove all sediment and water. 4) Replace with new wetland media and plant plants.	**6 to 8 Hours**

ATTACHMENT E

Soils Report

UPDATED GEOTECHNICAL EVALUATION
FOR
PROPOSED RESIDENTIAL DEVELOPMENT
ORANGE AVENUE SENIORS
9470 MOODY STREET AND 5081 ORANGE AVENUE
CITY OF CYPRESS, ORANGE COUNTY, CALIFORNIA

PREPARED FOR

MELIA HOMES
8951 RESEARCH DRIVE
IRVINE, CALIFORNIA 92618

PREPARED BY

GEOTEK, INC.
1548 N. MAPLE STREET
CORONA, CALIFORNIA 92880

PROJECT NO. 2573-CR **JANUARY 4, 2021**

GEOTEK

GeoTek, Inc.
1548 North Maple Street, Corona, California 92880
(951) 710-1160 Office (951) 710-1167 Fax www.geotekusa.com

January 4, 2021
Project No. 2573-CR

Melia Homes
8151 Research Drive
Irvine, California 92618

Attention: Mr. Chad Brown

Subject: Updated Geotechnical Evaluation
Proposed Residential Development
Orange Avenue Seniors
9470 Moody Street and 5081 Orange Avenue
City of Cypress, Orange County, California

Dear Mr. Brown:

We are pleased to provide herein the results of our updated geotechnical evaluation for the subject site located in the city of Cypress, County of Orange, California. This report presents a discussion of our evaluation and provides preliminary geotechnical recommendations for earthwork, foundation design, and construction. In our opinion, site development appears feasible from a geotechnical viewpoint provided that the recommendations included herein are incorporated into the design and construction phases of site development.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to call our office.

Respectfully submitted,
GeoTek, Inc.

Edward H. LaMont
CEG 1892, Exp. 07/31/22
Principal Geologist

Gaby Bogdanoff
GE 3133, Exp. 06/30/22
Project I Engineer

Distribution: .pdf file sent to addressee via email
G:\Projects\2551 to 2600\2573CR Melia Homes Orange Ave. Seniors Delevelopment Cypress\Updated Geotechnical Report\2573-CR Updated Geotechnical Evaluation 9470 Moody Street and 5081 Orange Avenue Cypress.docx

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ENCLOSURES

1. PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to complete a geotechnical evaluation of the existing geotechnical conditions of the project site. Services provided for this study included the following:

- Research and review of available geologic and geotechnical data, and general information pertinent to the site,
- Site reconnaissance,
- Site exploration consisting of the excavation, logging and sampling of ten exploratory hollow-stem borings,
- Collection of relatively undisturbed and bulk soil samples of the onsite materials,
- Laboratory testing of the soil samples collected from the site,
- Review and evaluation of site seismicity, and
- Compilation of this updated geotechnical report which presents our findings, conclusions, and recommendations for site development.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

The rectangular-shaped site is located on the north side of Orange Avenue and east of Moody Street in the city of Cypress, Orange County, California. The site is addressed as 9470 Moody Street and 5081 Orange Avenue. The roughly 6.3-acre site area is currently being used as a Cypress School District facility. The western-half of the site contains various one-story administration/educational buildings and associated parking/drive areas, while the eastern half consists of a maintenance yard. The maintenance yard includes numerous structures, vehicles, equipment, and materials and is asphalt concrete paved. Near the north property line, stockpiled soil up to eight feet high with a grass area further north and west are present. Access to the site is via driveways off Orange Avenue and Moody Street.

The site is relatively flat (not taking into consideration the stockpiled soil) with surface drainage directed to the south-southwest. Topographic relief across the site is less than two feet.

A perimeter wall marks the limits of the site to the north and east. The site limits to the south and west are partially defined by a chain-link fence.

The property is bounded by single-family residences to the north; a church facility to the east; Orange Avenue with single-family dwellings beyond to the south; and Moody Street with an animal hospital and single-family homes to the west.

The general location of the site is shown in Figure 1. The current conditions of the site and site topography are shown in the Exploration Location Map presented as Figure 2. Figure 2 uses the Boundary and Topographic Survey Plan, prepared by Salazar Surveying, dated September 12, 2017, as a base map.

2.2 PROPOSED DEVELOPMENT

It is our understanding that proposed development will consist of rough grading of the site and subsequent construction of various multi-family buildings for senior housing. The buildings are anticipated to be up to two-story in height and of wood-framed and stucco construction resting on shallow foundations and concrete floors. Structural loads are anticipated to be typical for this type of construction. Site improvements will include interior streets, driveways, a pool area, underground utilities, possibly small interior retaining walls and landscaped areas. In addition, we expect that cuts and fills up two feet in height to be required to achieve the proposed site grades.

If site development differs from the assumptions made herein, the recommendations included in this report should be subject to further review and evaluation. Site development plans should be reviewed by GeoTek when they become available. Additional geotechnical field exploration, analyses and recommendations may be necessary upon review of site development plans.

3. REPORT REVIEW

NMG Geotechnical, Inc. (NMG) issued on November 4, 2011 a report entitled *Preliminary Geotechnical Exploration and Design Parameters for Potential Residential Development, District Office Site, Cypress School District, City of Cypress, California*. This evaluation included the excavation of two exploratory borings to depths of 51.5 feet below existing ground surface and two Cone Penetration Test (CPT) soundings to depths of 50 feet within the project site. NMG described the earth materials at the site as younger alluvial deposits consisting of silty and clayey sand which were moist to saturated and loose to dense. Groundwater was reportedly present in the borings at depths of 8.25 and 10 feet. In addition, NMG noted that the upper 15 feet of the alluvium had relatively lower blow counts per foot as well as dry densities ranging from 78.3 to 108.2 pounds

per cubic foot (pcf) and water content ranging from 5.5 to 31.5 percent. NMG performed a liquefaction assessment for the site and found some liquefaction-prone layers below 10 feet in depth, with thicknesses between 1 and 3 feet. Total and differential seismic settlements were estimated to be 1.5 inches and 0.75 inches, respectively. Removal and recompaction on the order of 5 feet deep was suggested by NMG to mitigate the soft/loose upper alluvium. Very low expansion potential (EI = 2) and high R-value (RV = 64) were also reported by NMG for the upper alluvium.

Logs of the exploratory borings and soundings as well as laboratory test results by NMG are included in Appendix A.

4. FIELD EXPLORATION AND LABORATORY TESTING

4.1 FIELD EXPLORATION

GeoTek first investigated the subsurface soil conditions of the eastern-half portion of the property on September 25, 2017 via five exploratory borings to depths ranging from 11.5 to 13 feet. On December 8, 2020, the western half of the site was explored via five additional borings excavated to depths ranging from 7 to 8 feet. The approximate locations of our borings and the previous borings and CPT soundings by NMG are shown in the Exploration Location Map, presented as Figure 2. Logs of the exploratory borings performed by GeoTek are included in Appendix B. GeoTek collected relatively undisturbed and bulk samples of onsite soil materials from the borings and transported to our in-house geotechnical laboratory for laboratory testing.

4.2 LABORATORY TESTING

Laboratory testing was performed on selected relatively undisturbed and bulk soil samples collected during the field exploration. The purpose of the laboratory testing was to confirm the field classification of the soil materials encountered and to evaluate the soils physical properties for use in the engineering design and analysis. Results of the laboratory testing program along with a brief description and relevant information regarding testing procedures are included in Appendix C.

5. GEOLOGIC AND SOILS CONDITIONS

5.1 REGIONAL SETTING

The subject property is situated in the Peninsular Ranges geomorphic province. The Peninsular Ranges province is one of the largest geomorphic units in western North America. Basically, it extends roughly 975 miles from the north and extends from the Transverse Ranges geomorphic province to the tip of Baja California, from north to south. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Several major fault zones are found in this province. The Elsinore Fault zone and the San Jacinto Fault zone trend northwest-southeast and are found in the near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province.

More specific to the subject property, the site is located in an area geologically mapped to be underlain by younger alluvial fan deposits (Sasucedo, G.J., Greene, G.H., Kennedy, M.P., and Bezore, S.P. 2016). The closest fault to the subject site is the Newport-Inglewood Fault located approximately 5.5 miles to the southwest.

5.2 GENERAL SOIL/GEOLOGIC CONDITIONS

A brief description of the earth materials encountered below the site and within the area of anticipated construction is presented in the following section. Based on our field exploration and exploration by NMG (2011), the area of anticipated improvements is underlain by undocumented fill covering younger alluvium.

5.2.1 Undocumented Fill

Undocumented fill was encountered in some of our borings to approximately 3 to 4 feet below grade. The fill consisted of brown, moist, loose silty sand. The fill is likely associated with the current use of the site and may be thicker beneath existing building areas. In addition, stockpile soil up to 8 feet in height is situated within the northeastern portion of the site (See Figure 2).

5.2.2 Younger Alluvial Fan Deposits

Younger alluvium was encountered in our borings below the fill or at near ground surface and extended to the maximum depth explored of about 13 feet. The alluvium encountered generally consisted of brown to brownish gray, moist to very moist, soft sandy silt and loose to medium silty sand. The logs of the exploratory borings and data from the CPT soundings performed by

NMG show similar conditions with soft/loose alluvial materials up to a depth of 15 feet. Below 15 feet, the alluvium has alternating layers of silty sand, sandy silt, poorly graded sand, clay, and silty clay which are in a medium dense to dense/stiff state.

According to the test results by NMG and GeoTek, the near surface site-soils have a "very low" expansion potential when tested and classified in accordance with ASTM D 4829. Also, consolidation tests performed by GeoTek on relatively undisturbed samples of the upper 10 feet of the alluvium showed that these soils are moderately compressible and have slight to moderate potential for collapse. Laboratory test results are shown in Appendix C.

Detailed boring logs are provided in Appendices A and B.

5.3 SURFACE WATER AND GROUNDWATER

5.3.1 Surface Water

If encountered during the earthwork construction, surface water on this site is the result of precipitation or surface run-off from surrounding sites. Overall drainage in the area is variable, and most commonly directed toward the south-southwest. Provisions for surface drainage will need to be accounted for by the project civil engineer.

5.3.2 Groundwater

Groundwater was not encountered in our exploratory borings performed to a maximum depth of 13 feet. However, groundwater was found in NMG's borings at 8 and 10 feet below the ground surface at the time of drilling (see logs in Appendix A).

Historically highest groundwater at the site is reported to be about 10 feet below ground surface based on the *Seismic Hazard Zone Report for Los Alamitos 7.5-Minute Quadrangle* (California Department of Conservation, 1998).

The GeoTracker database (https://geotracker.waterboards.ca.gov/) indicates that groundwater monitoring wells were installed on site to evaluate the impact of an old leaking underground fuel tank. Groundwater levels were reported to fluctuate between 4 and 8 feet below grade.

It is possible that seasonal variations (temperature, rainfall, etc.) will cause fluctuations in the groundwater level. The groundwater levels presented in this report are the levels that were measured at the time of our field activities. It is recommended that the contractor determine the actual groundwater levels at the site at the time of the construction activities to determine the impact, if any, on the construction procedures.

5.4 FAULTING AND SEISMICITY

The geologic structure of the entire southern California area is dominated mainly by northwest-trending faults associated with the San Andreas system. The site is in a seismically active region. No active or potentially active fault is known to exist at this site nor is the site situated within an *"Alquist-Priolo"* Earthquake Fault Zone (Bryant and Hart, 2007; CGS, 1986). The subject property is not located within a State of California Seismic Hazard Zone for earthquake induced landsliding; however, the site is located within a State of California Seismic Hazard Zone for liquefaction (CGS, 1998).

5.4.1 Seismic Design Parameters

The site is located at approximately 33.8250 degrees Latitude and -118.0445 degrees Longitude. Site spectral accelerations (S_a and S_1), for 0.2 and 1.0 second periods for a Class "D" site, was determined from the SEAOC/OSHPD web interface that utilizes the USGS web services and retrieves the seismic design data and presents that information in a report format. Using the ASCE 7-16 option on the SEAOC/OSHPD website results in the values for S_{M1} and S_{D1} reported as "null-See Section 11.4.8" (of ASCE 7-16). As noted in ASCE 7-16, Section 11.4.8, a site-specific ground motion procedure is recommended for Site Class D when the value S_1 exceeds 0.2. The value S_1 for the subject site exceeds 0.2.

For a site Class "D", an exception to performing a site-specific ground motion analysis is allowed in ASCE 7-16 where S_1 exceeds 0.2 provided the value of the seismic response coefficient, Cs, is conservatively calculated by Eq 12.8-2 of ASCE 7-16 for values of $T \leq 1.5T_s$ and taken as equal to 1.5 times the value computed in accordance with either Eq. 12.8-3 for $T_L \geq T > 1.5T_s$ or Eq. 12.8-4 for $T > T_L$.

The results, based on the 2015 NEHRP and the 2019 CBC, are presented in the following table and we have assumed that the exception as allowed in ASCE 7-16 is applicable. If the exception is deemed not appropriate, a site-specific ground motion analysis will be required.

SITE SEISMIC PARAMETERS	
Mapped 0.2 sec Period Spectral Acceleration, S_S	1.476g
Mapped 1.0 sec Period Spectral Acceleration, S_1	0.524g
Site Coefficient for Site Class "D", F_a	1.0
Site Coefficient for Site Class "D", F_v	1.776
Maximum Considered Earthquake Spectral Response Acceleration for 0.2 Second, S_{MS}	1.476g
Maximum Considered Earthquake Spectral Response Acceleration for 1.0 Second, S_{M1}	0.931g
5% Damped Design Spectral Response Acceleration Parameter at 0.2 Second, S_{DS}	0.984g
5% Damped Design Spectral Response Acceleration Parameter at 1 second, S_{D1}	0.621g
Peak Ground Acceleration Adjusted for Site Class Effects, PGA_M	0.695g
Seismic Design Category	D

5.5 LIQUEFACTION AND SEISMICALLY INDUCED SETTLEMENT

Liquefaction describes a phenomenon in which cyclic stresses, produced by earthquake-induced ground motion, create excess pore pressures in relatively cohesionless and low plastic soils. These soils may thereby acquire a high degree of mobility, which can lead to lateral movement, sliding, consolidation and settlement of loose sediments, sand boils and other damaging deformations. This phenomenon occurs only below the water table, but, after liquefaction has developed, the effects can propagate upward into overlying non-saturated soil as excess pore water dissipates.

The factors known to influence liquefaction potential include soil type and grain size, relative density, groundwater level, confining pressures, and both intensity and duration of ground shaking. In general, materials that are susceptible to liquefaction are loose, saturated granular soils having low fines content under low confining pressures and some low plastic silts and clays.

Based on the review of onsite groundwater data, a historic high groundwater depth of 4 feet was used in our analysis. The soil profiles identified within CPT-1 and CPT-2 soundings by NMG were used for our liquefaction assessment. A mean magnitude weighted (Mw) seismic event of 6.72 (based on a 2 percent exceedance in 50 years) and a PGA_M value of 0.695g were used in our assessment. We assumed that the grading of the proposed residential pads will not incorporate significant cuts and/or fill and therefore the current confining stress will remain unchanged. The CPT data was used for the liquefaction analysis since the CPT provides a continuous log of the subsurface soils and is deemed a superior means of evaluation as compared to conventional borings. GeoTek evaluated the liquefaction potential of the on-site soils using the computer program *Cliq Version 2.0*.

The results of the analyses indicated the presence of some layers of loose sands and silty sands that would be prone to liquefaction and settlement. The following table summarizes the amount of total settlement (liquefaction settlement plus settlement of dry sands) estimated at each CPT location:

ESTIMATED SEISMICALLY INDUCED TOTAL SETTLEMENT	
CPT Sounding	Total Settlement (inches)
1	1.3
2	1.5

As noted above, seismically induced settlement of up to about 1.5 inches total and 0.75-inch differential over a 30-foot span is estimated for the property. The results of the liquefaction and seismic settlement analyses are presented within Appendix D.

Based on relationships developed by Ishihara (1985) with respect to the thickness of potentially liquefiable soils relative to the thickness of the non-liquefiable soils, it is our opinion that a potential does exist for surface manifestations (sand boils and/or loss of bearing support) to occur during the design level earthquake. Recommendations presented in subsequent sections of this report have been prepared to reduce the potential for surface manifestations.

Due to the flat topography of the site, the potential for lateral spreads is considered nil.

5.6 OTHER SEISMIC HAZARDS

Evidence of ancient landslides or slope instabilities at this site was not observed during our investigation. Thus, the potential for landslides is considered negligible.

The potential for secondary seismic hazards such as a seiche or tsunami is considered negligible due to site elevation and distance to an open body of water.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 GENERAL

The anticipated site development appears feasible from a geotechnical viewpoint provided that the following recommendations, and those provided by this firm at a later date are incorporated into the design and construction phases of development. Site development and grading and foundation plans should be reviewed by GeoTek, Inc. when they become available.

Site excavations indicate that the property contains loose undocumented fills and soft/loose to stiff/medium dense alluvial deposits. Therefore, to provide a dense, homogeneous support for the proposed structures, all undocumented fill and upper loose/soft alluvium should be removed and recompacted within the proposed structural grading limits. General removals on the order of 5 feet are anticipated.

Our analyses also indicate that the site may be subject to liquefaction and settlement during the design level earthquake. This could result in seismically induced settlement of up to about 1.5 inches total and 0.75-inch differential over a 30-foot span. Surface manifestation of liquefaction (sand boils and/or loss of bearing support) are also possible to occur.

According to ASCE 7-16, a maximum differential settlement of 3.6 inches over a 30-foot span can be tolerated by multistory structures with Risk Category II (structures of ordinary occupancy such as residential buildings). However, ASCE 7-16 indicates that standard shallow foundations may be designed where the settlement does not exceed one-fourth of the differential settlement threshold (i.e. 0.9 inches). Given that the estimated differential settlement exceeds one-fourth of the threshold and given that the property may be subject to potential manifestations of liquefaction, we recommend that site buildings be supported by either shallow footings with foundation ties, post-tensioned slabs, or mat foundations.

After the completion of the recommended remedial grading, we anticipate a total static settlement of less than 1-inch and a maximum differential static settlement of less than 0.5-inch in a 30-foot span for residential buildings resting on shallow footings with foundation ties. For structures resting on mat foundations or post-tensioned systems, a total settlement of about 2 inches and a differential settlement of about 1 inch over a horizontal distance of 30 feet are estimated. These static settlements along with the anticipated seismically induced settlements will result in up to 2.5 inches of combined (static plus seismic) total settlement and up to 1.3 inches of combined (static plus seismic) differential settlements over a horizontal distance of 30 feet for the future residential structures resting on shallow footings with foundation ties. For structures resting on mat foundations or post-tensioned systems, up to 3.5 inches of combined (static plus seismic) total settlement and up to 1.8 inches of combined (static plus seismic) differential settlements over a horizontal distance of 30 feet are estimated.

6.2 EARTHWORK CONSIDERATIONS

Earthwork and grading should be performed in accordance with the applicable grading ordinances of the City of Cypress and/or County of Orange, the *2019 California Building Code* (CBC), and recommendations contained in this report. Site grading plans should be reviewed by this office when they become available. Additional recommendations will likely be offered subsequent to review of these plans. The General Grading Guidelines included in Appendix E

outline general procedures and do not anticipate all site-specific situations. In the event of conflict, the recommendations presented in the text of this report should supersede those contained in Appendix E.

6.2.1 Site Clearing

The site should be cleared of existing vegetation, roots, stockpiled soil, and debris. All foundations, slabs, utilities, and underground improvements associated to the existing buildings should also be removed. These materials should be properly disposed of off-site. Voids resulting from site clearing should be backfilled with engineered fill.

6.2.2 Site Preparation

As a minimum, the upper 5 feet of existing soils or 3 feet below footing base, whichever is deeper, should be completely removed within the structural grading limits. The depth of over-excavation should be extended, where needed, to remove all undocumented fill. Removal bottoms should expose relatively uniform, moist alluvium that is not visibly porous or highly compressible. As a minimum, removals should extend down and away from foundation elements at a 1:1 projection, to the recommended removal depth.

All existing fill should be removed from surface improvement areas. A minimum of 12 inches of engineered fill should be provided below asphaltic concrete pavement and Portland cement concrete hardscape areas. The horizontal extent of removals should extend at least two feet beyond the edge. Development plans should be reviewed by this firm when available. Depending on actual field conditions encountered during grading, locally deeper areas of removal may be recommended.

The bottom of all removals should be scarified to a minimum depth of 12 inches, brought to slightly above the optimum moisture content, and then recompacted to at least 90 percent of the soil's maximum dry density, per ASTM D 1557. The bottoms of removals should be observed by a GeoTek representative prior to scarification.

The bottom of removals will likely encounter very moist and soft soils that may require stabilization. If necessary, removal bottoms may be stabilized with a layer of gravel and/or geogrid supplemented with gravel, prior to placing engineered compacted fill. A 12-inch thick layer of gravel has been successfully used on similar project sites that GeoTek has provided services on in the past.

6.2.3 Engineered Fill

The onsite soils are considered suitable for reuse as engineered fill provided they are free from vegetation, debris and other deleterious material. Rock fragments greater than 6 inches in maximum dimension should not be incorporated into engineered fill.

At the time of our field investigation, the on-site soils were very moist (approximately 5 to 18 percent above optimum water content). To be suitable for placement as engineered fill, these materials should be dried to approximately optimum moisture content.

Concrete generated from the demolition of existing site improvements may be incorporated into site fills provided the following guidelines are implemented: 1) concrete should be free of rebar or other deleterious materials and should be broken down to a maximum dimension of six inches; 2) concrete should not be placed within three feet of finish grade in the building pad areas or within one foot of subgrade elevations in the street/drive areas; 3) concrete should be distributed in the fill and should not be "nested" or placed in concentrated pockets.

Engineered fill materials should be placed in horizontal lifts not exceeding eight inches in loose thickness, moisture conditioned to over the optimum moisture content and compacted to a minimum relative compaction of 90 percent (ASTM D 1557).

6.2.4 Excavation Characteristics

Excavation in the onsite soil materials is expected to be easy using heavy-duty grading equipment in good operating conditions.

All temporary excavations for grading purposes and installation of underground utilities should be constructed in accordance with local and Cal-OSHA guidelines. Temporary excavations within the onsite materials should be stable at 1:1 (h:v) inclinations for cuts less than five feet in height.

6.2.5 Shrinkage and Subsidence

Several factors will impact earthwork balancing on the site, including shrinkage, bulking, subsidence, trench spoil from utilities and footing excavations, as well as the accuracy of topography.

Shrinkage, bulking and subsidence are primarily dependent upon the degree of compactive effort achieved during construction. For planning purposes, a shrinkage factor of 5 to 15 percent may be considered for the materials requiring removal and/or recompaction. Site balance areas should be available in order to adjust project grades, depending on actual field conditions at the

conclusion of site earthwork construction. Bulking is not considered to be a significant factor with the underlying materials within the vicinity of the anticipated construction. Subsidence on the order of up to 0.2 foot could occur.

6.2.6 Trench Excavations and Backfill

Temporary excavations within the onsite materials should be stable at 1:1 (h:v) inclinations for short durations during construction, and where cuts do not exceed 5 feet in height. Temporary cuts to a maximum height of four feet can be excavated vertically, but local sloughing and/or failure could occur due to the granular nature of some of the soils at this site. Increased caution should be applied when working near or within any excavations at this site.

Trench excavations should conform to Cal-OSHA regulations. The contractor should have a competent person, per OSHA requirements, on site during construction to observe conditions and to make the appropriate recommendations.

Utility trench backfill should be compacted to at least 90 percent relative compaction (as determined per ASTM D 1557). Under-slab trenches should also be compacted to project specifications. Where applicable, based on jurisdictional requirements, the top 12 inches of backfill below subgrade for onsite pavements should be compacted to at least 95 percent relative compaction. Onsite materials may not be suitable for use as bedding material but should be suitable as backfill provided particles larger than six± inches are removed.

Compaction should be achieved with a mechanical compaction device. Ponding or jetting of trench backfill is not recommended. If backfill soils have dried out, they should be thoroughly moisture conditioned prior to placement in trenches.

6.2.7 Slopes

Slopes at the site constructed at gradients of 2:1 (h:v) or flatter, in accordance with industry standards, are anticipated to be grossly stable. Fill placed on sloping ground should be properly benched into competent soils.

6.3 DESIGN RECOMMENDATIONS

6.3.1 Foundation Design Criteria

Our exploratory borings encountered relatively granular soils within the upper five to ten feet at the site. Our test results and results by NMG also indicate that the near surface soils have a "very low" ($0 \leq EI \leq 20$) potential for expansion in accordance with ASTM D 4829. However, verification testing should be performed after site remedial grading.

The foundation elements for the proposed structures should bear entirely in engineered fill soils and should be designed in accordance with the *2019 CBC*.

Because of the potential for liquefaction induced settlement and surface manifestations of liquefaction, it is our recommendation that foundation systems such as shallow footings with foundation ties, post-tensioned slabs, or mat foundations be used to support the planned buildings. After the completion of the recommended remedial grading, we anticipate a total static settlement of less than 1-inch and a maximum differential static settlement of less than 0.5-inch in a 30-foot span for residential buildings resting on shallow footings with foundation ties. For structures resting on mat foundations or post-tensioned systems, a total settlement of about 2 inches and a differential settlement of about 1 inch over a horizontal distance of 30 feet are estimated. These static settlements along with the anticipated seismically induced settlements will result in up to 2.5 inches of combined (static plus seismic) total settlement and up to 1.3 inches of combined (static plus seismic) differential settlements over a horizontal distance of 30 feet for the future residential structures resting on shallow footings with foundation ties. For structures resting on mat foundations or post-tensioned systems, up to 3.5 inches of combined (static plus seismic) total settlement and up to 1.8 inches of combined (static plus seismic) differential settlements over a horizontal distance of 30 feet are estimated.

Shallow Footings with Foundation Ties

A summary of our foundation design recommendations is presented in the following table.

MINIMUM DESIGN REQUIREMENTS FOR CONVENTIONALLY REINFORCED SHALLOW FOUNDATIONS	
Design Parameter	"Very Low" Expansion Potential
Foundation Depth or Minimum Perimeter Beam Depth (inches below lowest adjacent grade)	One-and Two-Story – 12
Minimum Foundation Width (Inches)*	One-story and Two-Story – 12
Minimum Slab Thickness (Inches)	4 – Actual
Minimum Slab Reinforcing	6" x 6" – W1.4/W1.4 welded wire fabric placed in middle of slab
Minimum Reinforcement for Continuous Footings, Grade Beams, and Retailing Wall Footings	Two No. 4 reinforcing bars, one placed near the top and one near the bottom
Effective Plasticity Index	NA**
Presaturation of Subgrade Soil (Percent of Optimum/Depth in Inches)	Minimum 100% of the optimum moisture content to a depth of at least 12 inches prior to placing concrete

*Code minimums per Table 1809.7 of the 2019 CBC should be complied with
**Effective Plasticity Index should be verified at the completion of the site remedial grading

These are minimal recommendations and are not intended to supersede the design by the project structural engineer. In addition, design of foundations on liquefiable sites should follow the provisions in ASCE 7-16 Section 12.13.9. Per ASCE 7-16 Section 12.13.9, shallow foundations underlain by potentially liquefiable soils are required to be interconnected by ties so that the differential settlement is reduced. Foundation ties are required when the estimated differential settlement exceeds one-fourth of the differential settlement threshold specified by Table 12.13-3 of ASCE 7-16.

In general, an allowable bearing capacity of 1,500 psf may be used for design of continuous and perimeter footings 12 inches deep and 12 inches wide, and pad footings 24 inches square and 12 inches deep. Additionally, an increase of one-third may be applied when considering short-term live loads (e.g. seismic and wind loads).

The passive earth pressure may be computed as an equivalent fluid having a density of 225 psf per foot of depth, to a maximum earth pressure of 2,500 psf for footings founded in engineered fill. A coefficient of friction between engineered fill and concrete of 0.40 may be used with dead load forces. The upper one foot of soil below the adjacent grade should not be used in calculating passive pressure. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

Post-Tensioned Slabs

The slab designer may choose the post-tension design methodology. Since the CBC indicated Post Tensioning Institute (PTI) design methodology is intended for expansive soils conditions which do not apply, no em or ym parameters as used in the PTI methodology are provided. However, the slab design should consider the estimated static and liquefaction induced settlements as noted above.

MINIMUM DESIGN REQUIREMENTS FOR POST-TENSIONED FOUNDATIONS	
Foundation Design Parameter	"Very Low" Expansion Potential
Foundation Depth or Minimum Perimeter Beam Depth (inches below lowest adjacent grade)	One- or Two-Story – 12 inches
Minimum Foundation Width	One- or Two-Story – 12 inches
Minimum Slab Thickness (actual)	5 inches
Presaturation of Subgrade Soil (Percent of Optimum)	Minimum 100% to a depth of 12 inches

It should be noted that the above recommendations are based on soil support characteristics only. The structural engineer should design the slab and beam reinforcement based on actual loading conditions.

An allowable bearing capacity of 1,000 psf may be used for design of post-tensioned slab foundations.

The passive earth pressure may be computed as an equivalent fluid having a density of 225 psf per foot of depth, to a maximum earth pressure of 2,500 psf for footings founded on engineered fill. A coefficient of friction between soil and concrete of 0.40 may be used with dead load forces. The upper one foot of soil below the adjacent grade should not be used in calculating passive pressure.

Mat Foundations

The mat foundations should have a minimum embedment depth of 12 inches and may be designed using an allowable bearing capacity of 1,000 psf. Reinforcement within the mat foundation should be determined by the structural engineer. Structural design should consider the estimated static and liquefaction induced settlements as noted above.

For resistance to lateral loads, an allowable coefficient of friction of 0.40 between the base of the foundation elements and underlying compacted fill material is recommended. In addition, an allowable passive resistance equal to an equivalent fluid density of 225 pcf acting against the foundations may be used to resist lateral forces. The top foot of passive resistance at foundations should be neglected unless the ground surface is covered by concrete or pavement.

Where the mat foundation is to be designed as a beam on an elastic foundation, it is our opinion that a modulus of subgrade reaction (k-value) of 200 pounds per cubic inch (pci) may be considered for design based on a presumed value for a 1-foot by 1-foot plate load test. Dependent upon how the mat slab is loaded, the subgrade modulus value may need to be geometrically modified.

A moisture and vapor retarding system should be placed below slabs-on-grade where moisture migration through the slab is undesirable. Guidelines for these are provided in the 2019 California Green Building Standards Code (CALGreen) Section 4.505.2 and the 2019 CBC Section 1907.1 and ACI 360R-10. The vapor retarder design and construction should also meet the requirements of ASTM E1643. A portion of the vapor retarder design should be the implementation of a moisture vapor retardant membrane.

It should be realized that the effectiveness of the vapor retarding membrane can be adversely impacted as a result of construction related punctures (e.g. stake penetrations, tears, punctures from walking on the aggregate layer, etc.). These occurrences should be limited as much as possible during construction. Thicker membranes are generally more resistant to accidental puncture than thinner ones. Products specifically designed for use as moisture/vapor retarders may also be more puncture resistant. Although the CBC specifies a six-mil vapor retarder membrane, it is GeoTek's opinion that a minimum ten mil thick membrane with joints properly overlapped and sealed should be considered, unless otherwise specified by the slab design professional. The membrane should consist of Stego wrap or the equivalent.

Moisture and vapor retarding systems are intended to provide a certain level of resistance to vapor and moisture transmission through the concrete, but do not eliminate it. The acceptable level of moisture transmission through the slab is to a large extent based on the type of flooring used and environmental conditions. Ultimately, the vapor retarding system should be comprised of suitable elements to limit migration of water and reduce transmission of water vapor through the slab to acceptable levels. The selected elements should have suitable properties (i.e., thickness, composition, strength, and permeability) to achieve the desired performance level. Consideration should be given to consulting with an individual possessing specific expertise in this area for additional evaluation.

Moisture retarders can reduce, but not eliminate, moisture vapor rise from the underlying soils up through the slab. Moisture retarders should be designed and constructed in accordance with applicable American Concrete Institute, Portland Cement Association, Post-Tensioning Concrete Institute, ASTM and California Building Code requirements and guidelines.

GeoTek recommends that a qualified person, such as the flooring contractor, structural engineer, and/or architect be consulted to evaluate the general and specific moisture vapor transmission paths and associated potential impact.

In addition, the recommendations in this report and our services in general are not intended to address mold prevention, since we along with geotechnical consultants in general, do not practice in areas of mold prevention. If specific recommendations are desired, a professional mold prevention consultant should be contacted.

6.3.2 Miscellaneous Foundation Recommendations

- To minimize moisture penetration beneath the slab on grade areas, utility trenches should be backfilled with engineered fill, lean concrete, or concrete slurry where they intercept the perimeter footing or thickened slab edge.
- Soils from the footing excavations should not be placed in the slab-on-grade areas unless properly compacted and tested. The excavations should be free of loose/sloughed materials and be neatly trimmed at the time of concrete placement.
- Under-slab utility trenches should be compacted to project specifications. Compaction should be achieved with a mechanical compaction device. If backfill soils have dried out, they should be thoroughly moisture conditioned prior to placement in trenches.

6.3.3 Foundation Set Backs

Foundations should comply with the following setbacks. Improvements not conforming to these setbacks are subject to the increased likelihood of excessive lateral movements and/or differential settlements. If large enough, these movements can compromise the integrity of the improvements. The following recommendations are presented:

- The outside bottom edge of all footings should be set back a minimum of H/2 (where H is the slope height) from the face of any ascending slope. The setback should be at least 5 feet and need not to exceed 15 feet. Where a retaining wall is constructed at the toe of the slope, the height of the slope should be measured from top of the wall to the top of the slope.

- The outside bottom edge of all footings should be set back a minimum of H/3 from the face of any descending slope. The setback should be at least 7 feet and need not exceed 40 feet.
- The bottom of all footings for structures near retaining walls should be deepened so as to extend below a 1:1 (h:v) projection upward from the bottom inside edge of the wall footing.
- The bottom of any existing foundations for structures should be deepened so as to extend below a 1:1 (h:v) projection upward from the bottom of the nearest excavation.

6.3.4 Retaining Wall Design and Construction

6.3.4.1 General Design Criteria

Recommendations presented in this report apply to typical masonry or concrete retaining walls with a maximum retained soil height of 6 feet. Additional review and recommendations should be requested for higher walls. These are typical design criteria and are not intended to supersede the design by the structural engineer.

Retaining wall foundations should be embedded a minimum of 12 inches into engineered fill. Walls should be designed using an allowable bearing capacity of 1,500 psf. An increase of one-third may be applied when considering short-term live loads (e.g. seismic and wind loads). The passive earth pressure may be computed as an equivalent fluid having a density of 225 psf per foot of depth, to a maximum earth pressure of 2,500 psf. A coefficient of friction between soil and concrete of 0.40 may be used with dead load forces. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

All earth retention structure plans, as applicable, should be reviewed by this office prior to finalization. The seismic design parameters as discussed in this report remain applicable to all proposed earth retention structures at this site, and should be properly incorporated into the design and construction of the structures.

Earthwork considerations, site clearing and remedial earthwork for all earth retention structures should meet the requirements of this report, unless specifically provided otherwise, or more stringent requirements or recommendations are made by the designer. The backfill material placement for all earth retention structures should meet the requirement of Section 6.3.4.4 in this report.

In general, cantilever earth retention structures, which are designed to yield at least 0.001H, where H is equal to the height of the earth retention structure to the base of its footing, may be

designed using the active condition. Rigid earth retention structures (including but not limited to rigid walls, and walls braced at top, such as typical basement walls) should be designed using the at-rest condition.

In addition to the design lateral forces due to retained earth, surcharges due to improvements, such as an adjacent building or traffic loading, should be considered in the design of the earth retention structures. Loads applied within a 1:1 (h:v) projection from the surcharge on the stem and footing of the earth retention structure should be considered in the design.

Final selection of the appropriate design parameters should be made by the designer of the earth retention structures.

6.3.4.2 Cantilevered Walls

The recommendations presented below are for cantilevered walls retaining up to 6 feet of soil. Active earth pressure may be used for retaining wall design, provided the top of the wall is not restrained from minor deflections. An equivalent fluid pressure approach may be used to compute the horizontal pressure against the wall. Appropriate fluid unit weights are given below for specific slope gradients of the retained material. These do not include other superimposed loading conditions such as traffic, structures, or adverse geologic conditions.

ACTIVE EARTH PRESSURES	
Surface Slope of Retained Materials (h:v)	Equivalent Fluid Pressure (pcf) (Native Backfill)*
Level	37
2:1	60

* The design pressures assume the backfill material has an expansion index less than or equal to 20. Backfill zone includes area between back of the wall to a plane (1:1 h:v) up from bottom of the wall foundation (on the backside of the wall) to the (sloped) ground surface.

6.3.4.3 Restrained Retaining Walls

Retaining walls that will be restrained at the top that support level backfill or that have reentrant or male corners, should be designed for an equivalent at-rest fluid pressure of 60 pcf, plus any applicable surcharge loading for level backfill conditions. For areas of male or reentrant corners, the restrained wall design should extend a minimum distance of twice the height of the wall laterally from the corner, or a distance otherwise determined by the project structural engineer.

6.3.4.4 Retaining Wall Backfill and Drainage

Retaining walls should be provided with an adequate pipe and gravel back drain system to help prevent buildup of hydrostatic pressures. Backdrains should consist of a four-inch diameter perforated collector pipe (Schedule 40, SDR 35, or approved equivalent) embedded in a minimum of one-cubic foot per linear foot of ¾- to 1-inch clean crushed rock or an approved equivalent, wrapped in filter fabric (Mirafi 140N or an approved equivalent). The drain system should be connected to a suitable outlet. Waterproofing of site walls should be performed where moisture migration through the wall is undesirable.

Retaining wall backfill should be placed in lifts no greater than eight inches in thickness and compacted to a minimum of 90 percent relative compaction in accordance with ASTM Test Method D 1557. The wall backfill should also include a minimum one-foot wide section of ¾- to 1-inch clean crushed rock (or an approved equivalent). The rock should be placed immediately adjacent to the back of the wall and extend up from a back drain to within approximately two feet of the finish grade. The rock should be separated from the earth with filter fabric. The upper two feet should consist of compacted on-site soil.

As an alternative to the drain rock and fabric, Miradrain 2000, or approved equivalent, may be used behind the retaining wall. The Miradrain 2000 should extend from the base of the wall to within two feet of the ground surface. The subdrain should be placed at the base of the wall in direct contact with the Miradrain 2000.
The presence of other materials might necessitate revision to the parameters provided and modification of the wall designs. Proper surface drainage needs to be provided and maintained.

6.3.4.5 Other Design Considerations

- Wall design should consider the additional surcharge loads from superjacent slopes and/or footings, where appropriate.
- No backfill should be placed against concrete until minimum design strengths are evident by compression tests of cylinders.
- The retaining wall footing excavations, backcuts, and backfill materials should be approved the project geotechnical engineer or their authorized representative.

6.3.5 Pool Construction

Because of the presence of relatively shallow groundwater, dewatering systems may be required to facilitate the excavation of the pool area. We recommend that the water table be lowered

to a least two feet below the deepest excavation and maintained at that depth until the pool is constructed and filled.

The proposed swimming pool should derive support entirely from engineered fill. A minimum 12 inches of engineered fill should be provided below the pool shell.

The pool walls should be designed for at-rest soil conditions using an equivalent fluid density of 60 pcf for at-rest conditions. Pool walls surcharged by adjacent structures should be designed for additional pressures. Alternatively, the pool walls may be designed as freestanding walls using the active soil state conditions provided that some lateral movement of the pool walls would be acceptable. If the active state is to be used, an equivalent fluid density of 37 pcf is considered suitable. These pressures are recommended for sections of the pool walls above the groundwater table and are based on drained conditions. Below the groundwater level (about six to eight feet), the pool walls should then be designed for an equivalent fluid density of 83 pcf for the active condition and 94 pcf for the at-rest condition. These values include the hydrostatic pressure.

Due to the high groundwater table under the site, positive drainage below the pool may not be feasible. We recommend that the pool walls be designed to include the hydrostatic pressure as indicated above. Also, buoyancy of the pool should be evaluated by the pool designer using a groundwater level of about five feet below the existing ground surface. The pool designer should consider hydrostatic relief valves or equivalent in order to prevent the effects of hydrostatic pressure on an empty pool shell.

Pool decking supported on grade should be separated from the pool bond beam by a full-depth, mastic construction joint. If it is desired to extend the pool deck over the bond beam, consideration should be given to designing the deck as a structural slab supported by the pool shell. This will reduce the possibility of deck cracking occurring along the outer edge of the bond beam. We also recommend that the area of the pool decking be pre-saturated prior to concrete placement. The subgrade soils should be moisture conditioned to at least 100 percent of the soil's optimum moisture content to a depth of 12 inches, prior to concrete placement. Testing by the geotechnical engineer is recommended to confirm that the soils have been adequately moisture treated.

Pool decking may consist of five-inch thick concrete and the use of reinforcement is suggested. Control joints should be placed in two directions and located a distance apart approximately equal to 24 to 36 times the slab thickness. The project structural engineer should provide final design recommendations.

6.3.6 Underground Utility Considerations

Due to the high groundwater table under the site and in the vicinity, underground utilities deeper than 5 feet should consider buoyancy in their design.

6.3.7 Pavement Design Considerations

Pavement design for proposed street improvements was conducted per Caltrans *Highway Design Manual* guidelines for flexible pavements. Based on a design R-value of 50 (NMG, 2011) for Traffic Indices (TIs) of 5.0 and 6.0 generally linked to roads with light vehicular traffic with occasional heavy truck traffic, the following sections were calculated:

PRELIMINARY PAVEMENT SECTIONS		
Traffic Index	Thickness of Asphalt Concrete (feet)	Thickness of Aggregate Base (Feet)
5.0	0.25*	0.50*
6.0	0.25*	0.50*

*Minimum thickness per City of Cypress Street Standards.

Traffic Indices (TIs) used in our pavement design are considered reasonable values for the proposed pavement areas and should provide a pavement life of approximately 20 years with a normal amount of flexible pavement maintenance. Irrigation adjacent to pavements, without a deep curb or other cutoff to separate landscaping from the paving will result in premature pavement failure. Traffic parameters used for design were selected based upon engineering judgment and not upon information furnished to us such as an equivalent wheel load analysis or a traffic study.

The recommended pavement sections provided are intended as a minimum guideline and final selection of pavement cross section parameters should be made by the project civil engineer, based upon the local laws and ordinates, expected subgrade and pavement response, and desired level of conservatism. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected. Final pavement design should be checked by testing of soils exposed at subgrade (the upper one foot) after final grading has been completed.

Asphalt concrete and aggregate base should conform to current Caltrans Standard Specifications Section 39 and 26-1.02, respectively. As an alternative, asphalt concrete can conform to Section 203-6 of the current Standard Specifications for Public Work (Green Book). Crushed aggregate base or crushed miscellaneous base can conform to Section 200-2.2 and 200-2.4 of the Green Book, respectively. Pavement base should be compacted to at least 95 percent of the ASTM D1557 laboratory maximum dry density (modified proctor).

All pavement installation, including preparation and compaction of subgrade, compaction of base material, placement and rolling of asphaltic concrete, should be done in accordance with the City of Cypress specifications, and under the observation and testing of GeoTek and a City Inspector where required. Jurisdictional minimum compaction requirements in excess of the aforementioned minimums may govern.

Deleterious material, excessive wet or dry pockets, oversized rock fragments, and other unsuitable yielding materials encountered during grading should be removed. Once existing compacted fill are brought to the proposed pavement subgrade elevations, the subgrade should be proof-rolled in order to check for a uniform and unyielding surface. The upper 12 inches of pavement subgrade soils should be scarified, moisture conditioned at or near optimum moisture content, and recompacted to at least 95 percent of the laboratory maximum dry density (ASTM D1557). Rock fragments over six inches in one dimensions should not be placed within the upper 12 inches of the subgrade. If loose or yielding materials are encountered during construction, additional evaluation of these areas should be carried out by GeoTek. All pavement section changes should be properly transitioned.

6.3.8 Soil Corrosivity

The soil resistivity was tested in the laboratory on two samples collected during our field exploration. The results of the testing (5,226 and 8,040 ohm-cm) indicate that the tested soil samples are "moderately corrosive" to buried metals, based on the guidelines provided in *Corrosion Basics: An Introduction* (Roberge, 2005). Soil resistivity testing performed by NMG (2011) revealed a "severely" corrosive to "moderately" corrosive category for the on-site materials (73 to 2,320 ohm-cm).

Chloride content of the samples tested by GeoTek (20 and 126 ppm) was found to be negligible. Chloride concentration measured by NMG (2011) was noted to range from "negligible" to "corrosive" (11 to 685 ppm). Consideration should be given to consulting with a corrosion engineer.

6.3.9 Soil Sulfate Content

The sulfate content was determined in the laboratory for two soil samples obtained during our field investigation. The results (0.0003 and 0.0054 percent) indicate that the tested water-soluble sulfate is negligible, per Table 4.2.1 of ACI 318. NMG reported similar findings regarding the soil sulfate content. Based upon the test results, no special concrete mix design is required by Code for sulfate attack resistance. Additional sampling and testing should be performed once the site grading is complete.

6.3.10 Import Soils

Import soils should have an Expansion Index of less than 20 (very low) and should not possess oversized or deleterious materials. GeoTek also recommends that, as a minimum, proposed import soils be tested for soluble sulfate content. GeoTek should be notified a minimum of 72 hours of potential import sources so that appropriate sampling and laboratory testing can be performed.

6.3.11 Concrete Flatwork

6.3.11.1 Exterior Concrete Slabs, Sidewalks, and Driveways

Exterior concrete slabs, sidewalks, and driveways should be designed using a four-inch minimum thickness. No specific reinforcement is required due to the non-structural nature. However, the use of some reinforcement should be considered. Recommendations can be provided upon request. Some shrinkage and cracking of the concrete should be anticipated as a result of typical mix designs and curing practices commonly utilized in residential construction.

Sidewalks and driveways may be under the jurisdiction of the governing agency. If so, jurisdictional design and construction criteria would apply, if more restrictive than the recommendations presented herein.

Subgrade soils, classified as having "very low" expansion potential, should be pre-moistened prior to placing concrete. The subgrade soils below exterior slabs, sidewalks, driveways, etc. at the subject site should be pre-saturated to a minimum of 100 percent of optimum moisture content to a depth of 12 inches.

All concrete installation, including preparation and compaction of subgrade, should be done in accordance with the City of Cypress/County of Orange specifications, and under the observation and testing of GeoTek and a City Inspector, if necessary.

6.3.11.2 Concrete Performance

Concrete cracks should be expected. These cracks can vary from sizes that are essentially unnoticeable to more than 1/8 inch in width. Most cracks in concrete, while unsightly, do not significantly impact long-term performance. While it is possible to take measures (proper concrete mix, placement, curing, control joints, etc.) to reduce the extent and size of cracks that occur, some cracking will occur despite the best efforts to minimize it. Concrete can also undergo chemical processes that are dependent on a wide range of variables, which are difficult,

at best, to control. Concrete, while seemingly a stable material, is also subject to internal expansion and contraction due to external changes over time.

One of the simplest means to control cracking is to provide weakened control joints for cracking to occur along. These do not prevent cracks from developing; they simply provide a relief point for the stresses that develop. These joints are a widely accepted means to control cracks but are not always effective. Control joints are more effective the more closely spaced they are. GeoTek suggests that control joints be placed in two directions and located a distance apart roughly equal to 24 to 36 times the slab thickness.

Exterior concrete flatwork (patios, walkways, driveways, etc.) is often some of the most visible aspects of site development. They are typically given the least level of quality control, being considered "non-structural" components. We suggest that the same standards of care be applied to these features as to the structure itself.

6.4 POST CONSTRUCTION CONSIDERATIONS

6.4.1 Landscape Maintenance and Planting

Water has been shown to weaken the inherent strength of soil, and slope stability is significantly reduced by overly wet conditions. Positive surface drainage away from graded slopes should be maintained and only the amount of irrigation necessary to sustain plant life should be provided for planted slopes. Controlling surface drainage and runoff, and maintaining a suitable vegetation cover can minimize erosion. Plants selected for landscaping should be lightweight, deep-rooted types that require little water and are capable of surviving the prevailing climate.

Overwatering should be avoided. The soils should be maintained in a solid to semi-solid state as defined by the materials Atterberg Limits. Care should be taken when adding soil amendments to avoid excessive watering. Leaching as a method of soil preparation prior to planting is not recommended. An abatement program to control ground-burrowing rodents should be implemented and maintained. This is critical as burrowing rodents can decreased the long-term performance of slopes.

It is common for planting to be placed adjacent to structures in planter or lawn areas. This will result in the introduction of water into the ground adjacent to the foundation. This type of landscaping should be avoided. If used, then extreme care should be exercised with regard to the irrigation and drainage in these areas.

6.4.2 Drainage

The need to maintain proper surface drainage and subsurface systems cannot be overly emphasized. Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond or seep into the ground. Pad drainage should be directed toward approved area(s) and not be blocked by other improvements.

It is the owner's responsibility to maintain and clean drainage devices on or contiguous to their lot. In order to be effective, maintenance should be conducted on a regular and routine schedule and necessary corrections made prior to each rainy season.

6.5 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

We recommend that site grading plans, pool plans, retaining wall plans, foundation plans, and relevant project specifications be reviewed by this office prior to construction to check for conformance with the recommendations of this report. We also recommend that GeoTek representatives be present during site grading and foundation construction to check for proper implementation of the geotechnical recommendations. The owner/developer should verify that GeoTek representatives perform at least the following duties:

- Observe site clearing and grubbing operations for proper removal of unsuitable materials.
- Observe and test bottom of removals prior to fill placement.
- Evaluate the suitability of onsite and import materials for fill placement, and collect soil samples for laboratory testing where necessary.
- Observe the fill for uniformity during placement, including utility trenches.
- Perform field density testing of the fill materials.
- Observe and probe foundation excavations to confirm suitability of bearing materials.

If requested, a construction observation and compaction report can be provided by GeoTek, which can comply with the requirements of the governmental agencies having jurisdiction over the project. We recommend that these agencies be notified prior to commencement of construction so that necessary grading permits can be obtained.

7. INTENT

It is the intent of this report to aid in the design and construction of the proposed development. Implementation of the advice presented in Section 6 of this report is intended to reduce risk associated with construction projects. The professional opinions and geotechnical advice contained in this report are not intended to imply total performance of the project or guarantee that unusual or variable conditions will not be discovered during or after construction.

The scope of our evaluation is limited to the boundaries of the subject site. This review does not and should in no way be construed to encompass any areas beyond the specific area of the proposed construction as indicated to us by the client. Further, no evaluation of any existing site improvements is included. The scope is based on our understanding of the project and the client's needs, our fee estimate (P-1006220-CR) dated October 15, 2020 and geotechnical engineering standards normally used on similar projects in this region.

8. LIMITATIONS

The materials observed on the project site appear to be representative of the area; however, soil materials vary in character between excavations or conditions exposed during site construction. Site conditions may vary due to seasonal changes or other factors. GeoTek, Inc. assumes no responsibility or liability for work, testing or recommendations performed or provided by others.

Since our recommendations are based on the site conditions observed and encountered, and laboratory testing, our conclusion and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty is expressed or implied. Standards of practice are subject to change with time.

9. SELECTED REFERENCES

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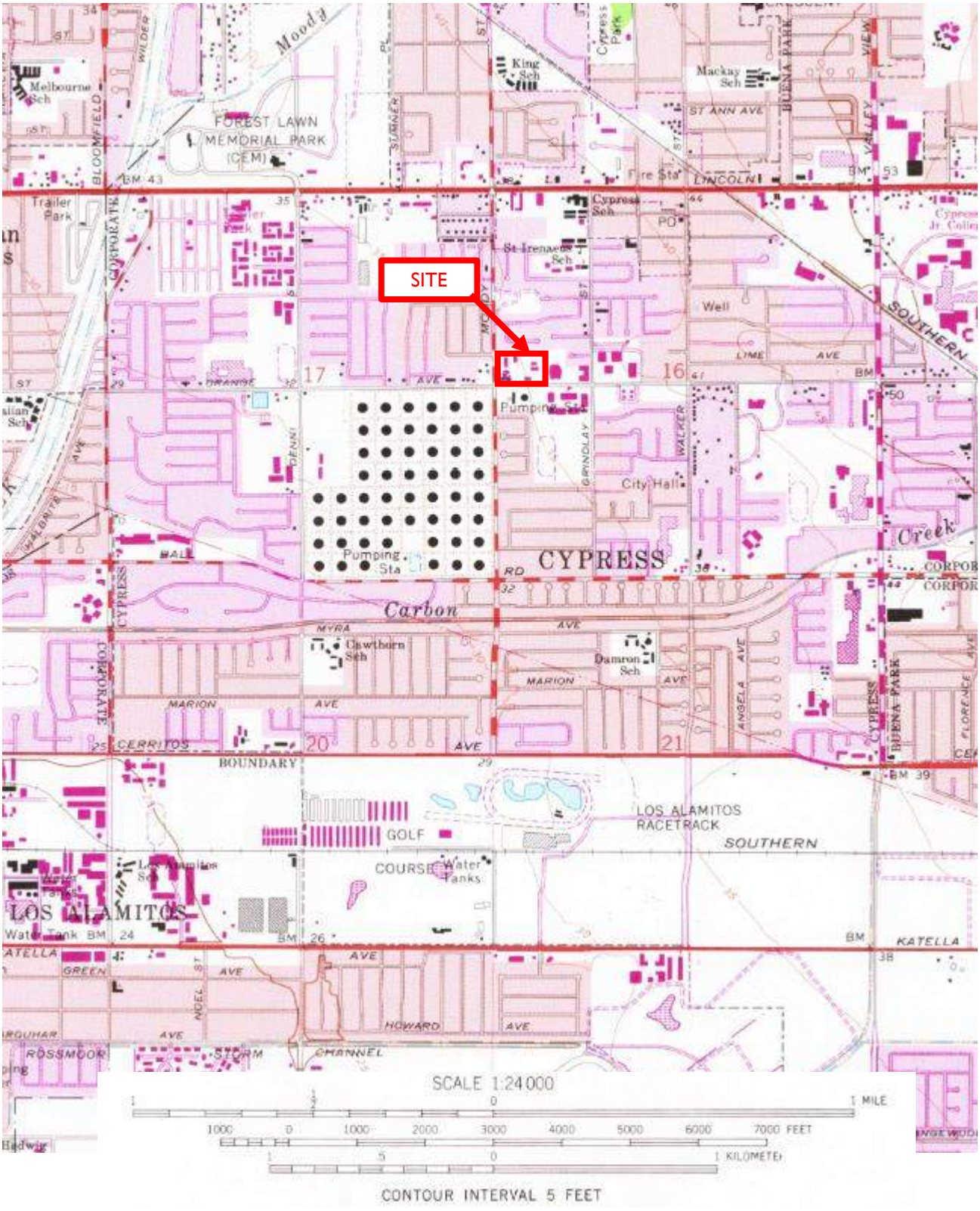


Melia Homes
Orange Avenue Seniors
9470 Moody Street and 5081 Orange Avenue
City of Cypress, Orange County, California

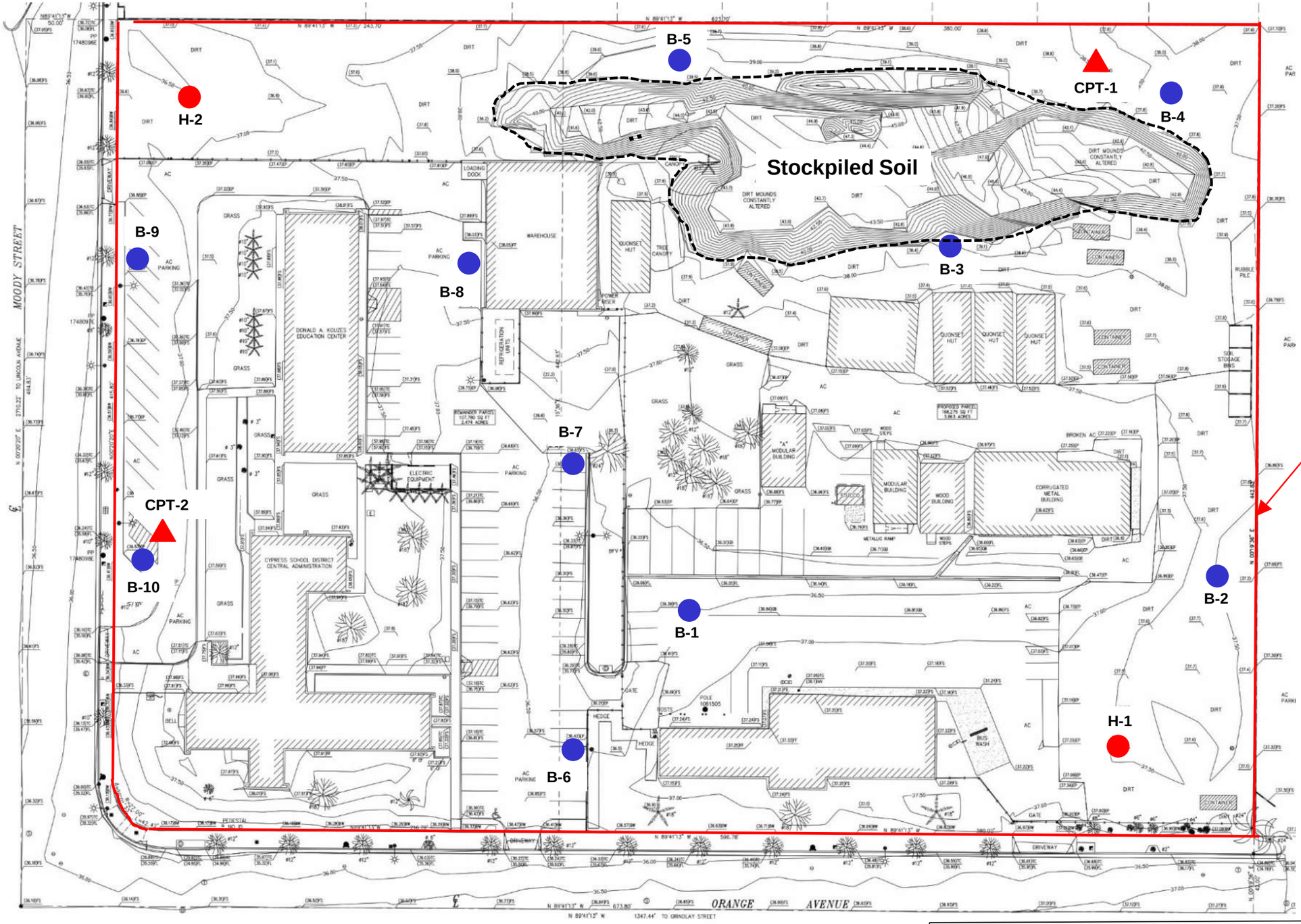
Project No. 2573-CR

N

Modified from USGS 7.5-minute Los Alamitos Topographic Map

Figure 1
Site Location Map

GEOTEK



LEGEND

CPT-2 ▲	Approximate Location of CPT Sounding (NMG, 2011)
H-2 ●	Approximate Location of Exploratory Boring (NMG, 2011)
B-10 ●	Approximate Location of Exploratory Boring by GeoTek

Scale =As Shown

0 65 ft

Melia Homes
Orange Avenue Seniors
9470 Moody Street and 5081 Orange Avenue
Cypress, Orange County, California

Project No. 2573-CR

GEOTEK

Figure 2

Exploration Location Map

APPENDIX A

BORING AND CPT LOGS
LABORATORY TEST RESULTS BY NMG (2011)

Updated Geotechnical Evaluation
Orange Avenue Seniors, Cypress, California
Project No. 2573-CR

GEOTEK

Date(s) Drilled	10/4/11	Logged By	LC
Drilling Company	2R Drilling	Drill Bit Size/Type	8"
Drill Rig Type	CME 55	Hammer Data	140 llbs @ 30"
Sampling Method(s)	Modified California, Bulk		
Approximate Groundwater Depth:	Groundwater at 8.25 Feet after 3 Hours.		
Comments			

H-1

Sheet 1 of 2

Total Depth Drilled (ft)	51.5
Approximate Ground Surface Elevation (ft)	37.0

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					SM	@Surface: 1/2" Crushed rock and rounded gravel. **Alluvium (Qal)**			B-1 (0'-5')
			B-1							
			D-1	25			@2.5 Grayish brown silty SAND, moist, medium dense, scattered gravel in top, slightly porous.	13.8	105.9	
							@4' Pale yellowish brown SAND and silty SAND.			
	5		D-2	10			@5' Grayish brown silty bSAND, moist, loose, friable, micaceous.	21.6	78.3	
-30			D-3	3			@7.5' Gray silty SAND, very moist, loose, friable, micaceous, slightly porous.	31.5	88.5	CN
	10		D-4	11		SM/SC	@10' Grayish brown silty clayey SAND, very moist to saturated, loose, friable, micaceous, slightly porous.	26.3	96.7	
	15		D-5	17		SP/SM	@15' Pale yellowish brown silty SAND and poorly graded SAND, saturated, loose to medium dense, friable, micaceous.	27.6	95.1	GS
-20										
	20		D-6	21			@20' Olive gray silty SAND and fine grained SAND, saturated, medium dense, friable, micaceous, slightly bedded.	25.9	99.8	
	25		D-7	18		SM/ML	@25' Dark olive gray SILT and very fine grained SAND with some clay, very moist to saturated, medium stiff / medium dense, micaceous, friable.	24.1	102.2	
-10										
	30									

LOG OF BORING

CSD/ District Office
Cypress, California
PROJECT NO. 11050-02

NMG

CSD/ District Office Cypress, California

H-1
Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	30	D	8	16		SP/SM	@30' Dark olive gray SAND and silty SAND, saturated, loose to medium dense, highly micaceous, slightly porous, scattered fine organic fibers.	19.7	109.5	
	35	D	9	25			@35' Dark olive gray SAND and silty SAND, medium dense, saturated, friable, highly micaceous.	23.4	102.3	
0	40	D	10	11			@40' Pale yellowish brown SAND, very moist to saturated, loose, micaceous, layers of silty SAND.	20.2	105.2	
	45	D	11	70		SP	@45' Light olive gray SAND with scattered pebbles, saturated, dense, friable, micaceous.	23.0	104.4	
-10	50	D	12	28		SM/ML	@50' Olive gray SILT and silty fine grained SAND, saturated, stiff / medium dense, highly micaceous, scattered small gravel.	24.1	101.0	
							Notes: Total Depth: 51.5 Feet. Groundwater at 8.25 Feet after 3 Hours. Backfilled With Cuttings, Bentonite and Sand Mix.			
	55									
-20	60									
	65									

LOG OF BORING

CSD/ District Office
Cypress, California

PROJECT NO. 11050-02

NMG

Date(s) Drilled	10/4/11	Logged By	LC
Drilling Company	2R Drilling	Drill Bit Size/Type	8"
Drill Rig Type	CME 55	Hammer Data	140 lbs @ 30"
Sampling Method(s)	Modified California, Bulk		
Approximate Groundwater Depth:	Groundwater Encountered at 10 Feet.		
Comments			

H-2

Sheet 1 of 2

Total Depth Drilled (ft)	51.5
Approximate Ground Surface Elevation (ft)	37.0

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					SM/SC	@Surface: Grass **Alluvium (Qal)**	8.4		B-1 (0'-5) AL, CC, EI, GS, MD, RV
			B-1							
			D-1	13			@2.5' Pale brown silty and clayey fine grained SAND and sandy SILT, dry to damp, loose / medium stiff, friable, micaceous, scattered root hairs.	5.5	97.7	
	5		D-2	11		ML	@5' Olive gray SILT and clayey SILT, very moist, medium stiff, highly micaceous.	25.7	93.9	CN, DS
-30			D-3	8		SC/CL	@7.5' Gray clayey SAND / sandy CLAY, saturated, loose / soft to medium stiff, highly micaceous.	28.6	100.6	
	10		D-4	8		CL	▼ @10' Gray sandy CLAY, saturated, soft to medium stiff, highly micaceous, slightly porous, scattered pebbles to 1/4".	31.5	92.8	GS
	15		D-5	18		SM	@15' Olive gray silty fine grained SAND, very moist to saturated, loose to medium dense, friable, highly micaceous.	25.8	96.7	
-20										
	20		D-6	27		SM/ML	@20' Olive gray silty fine grained SAND and sandy SILT, saturated, medium dense / stiff, highly micaceous.	25.2	100.8	
	25		D-7	19		SC/ML	@25' Olive gray clayey SAND and sandy SILT, saturated, medium dense / stiff, micaceous, slightly porous.	27.1	102.7	
-10										
	30									

LOG OF BORING

CSD/ District Office
Cypress, California
PROJECT NO. 11050-02

NMG

CSD/ District Office Cypress, California

H-2
Sheet 2 of 2

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	30									
		D	8	16		SC/CL	@30' Olive gray silty CLAY and clayey SAND, very moist to saturated, stiff / medium dense, highly micaceous, scattered calcium carbonate nodules.	23.5	99.6	
	35	D	9	17		SC	@35' Olive brown clayey SAND, saturated, medium dense, micaceous.	21.8	108.2	
0										
	40	D	10	25		SP/SM	@40' Olive gray SAND and silty fine grained SAND, saturated, medium dense, highly micaceous, friable.	24.5	98.0	
	45	D	11	28		SP	@45' Olive gray SAND, saturated, medium dense, friable, micaceous.	20.8	106.0	
-10										
	50	D	12	23		SC/ML	@50' Olive gray SILT and clayey fine grained SAND, very moist, stiff / medium dense, highly micaceous.	26.4	98.4	
							Notes: Total Depth: 51.5 Feet. Groundwater Encountered at 10 Feet. Backfilled With Cuttings, Bentonite and Sand Mix.			
	55									
-20										
	60									
	65									

LOG OF BORING

CSD/ District Office
Cypress, California

PROJECT NO. 11050-02

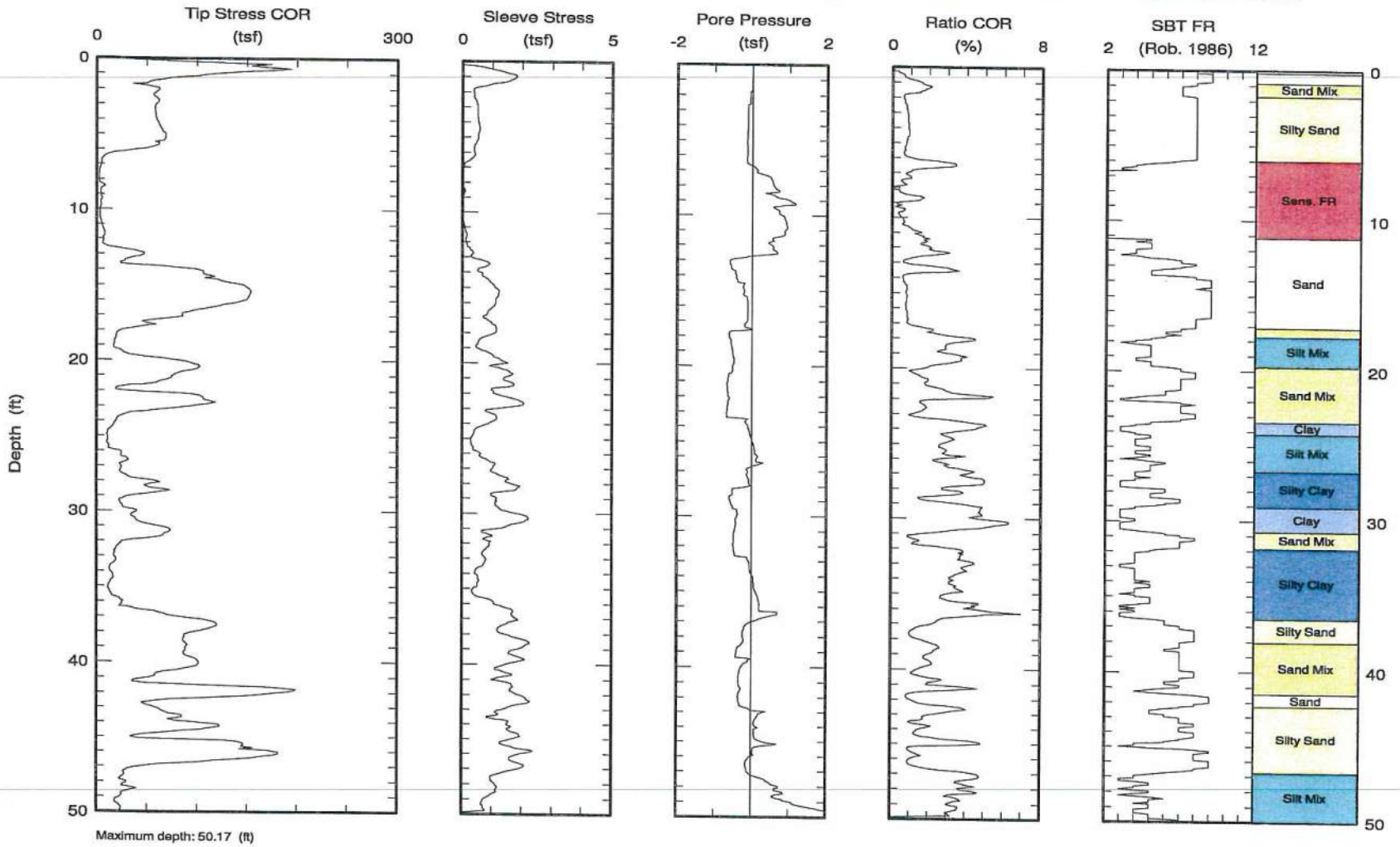
NMG

Kehoe Testing & Engineering
Office: (714) 901-7270
Fax: (714) 901-7289
rich@kehoetesting.com
www.kehoetesting.com

CPT Data
30 ton rig

Date: 04/Oct/2011
Test ID: CPT-1
Project: Cypress

Customer: NMG Geotechnical, Inc.
Job Site: Cypress School District



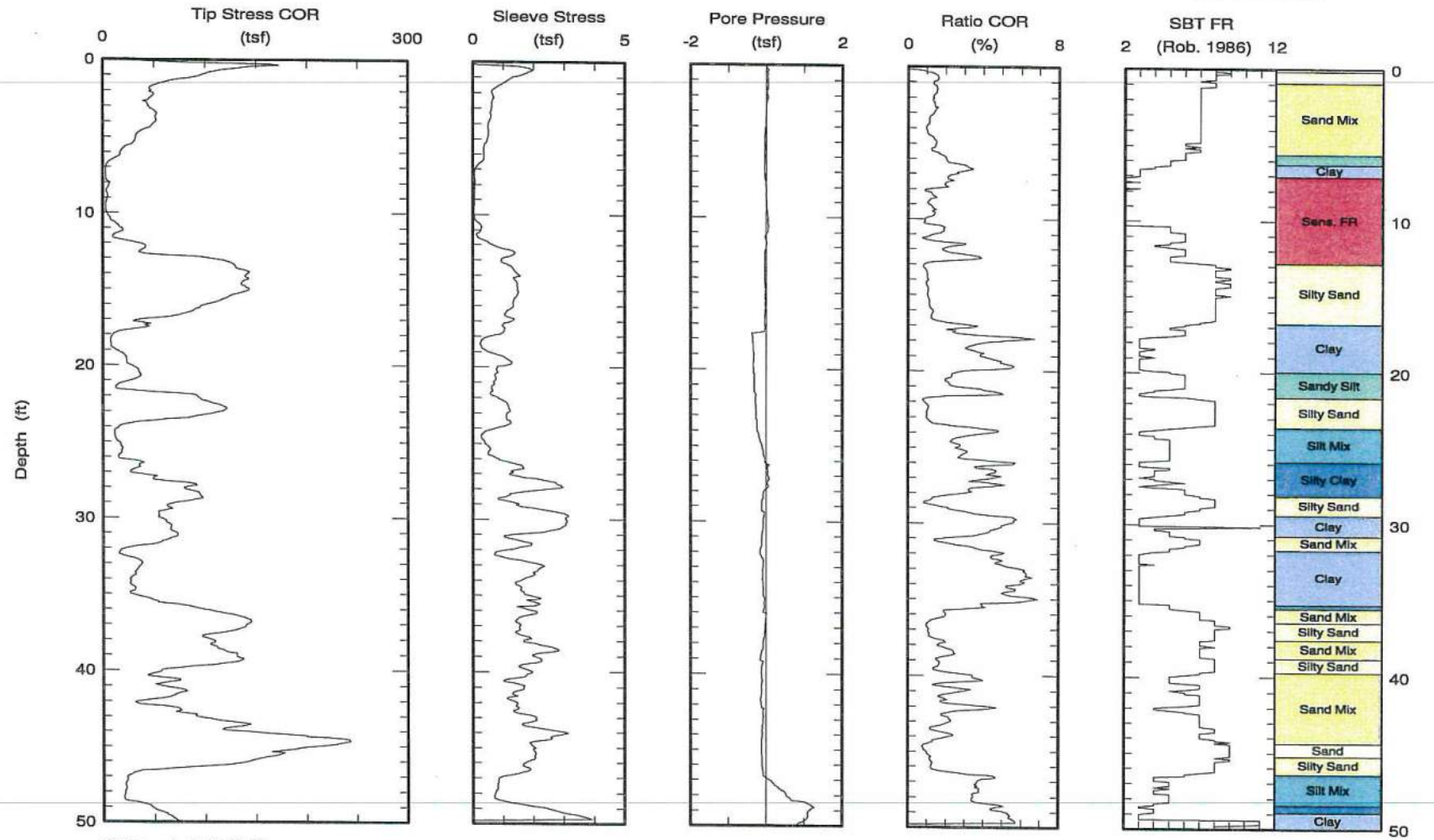
Maximum depth: 50.17 (ft)

Kehoe Testing & Engineering
Office: (714) 901-7270
Fax: (714) 901-7289
rich@kehoetesting.com
www.kehoetesting.com

CPT Data
30 ton rig

Date: 04/Oct/2011
Test ID: CPT-2
Project: Cypress

Customer: NMG Geotechnical, Inc.
Job Site: Cypress School District



Maximum depth: 50.14 (ft)

Sample	Compacted Moisture (%)	Compacted Dry Density (pcf)	Final Moisture (%)	Volumetric Swell (%)	Expansion Index[1] Value/Method		Expansive Classification[2]	Soluble Sulfate (%)	Sulfate Exposure[3]
HA-2 B-1 0-5'	8.4	103.0	19.9	0.2	2	A	Very Low	--	--

Test Method:

ASTM D4829 / UBC Standard 18-2

HACH SF-1 (Turbidimetric)

Notes:

1. Expansion Index (EI) method of determination:
   [A] E.I. determined by adjusting water content to achieve a 50±1% degree of saturation
   [B] E.I. calculated based on measured saturation within the range of 40% and 60%
2. 1994 UBC Table 18-1-B
3. 1994 UBC Table 19-A-3

Expansion Index and Soluble Sulfate Test Results

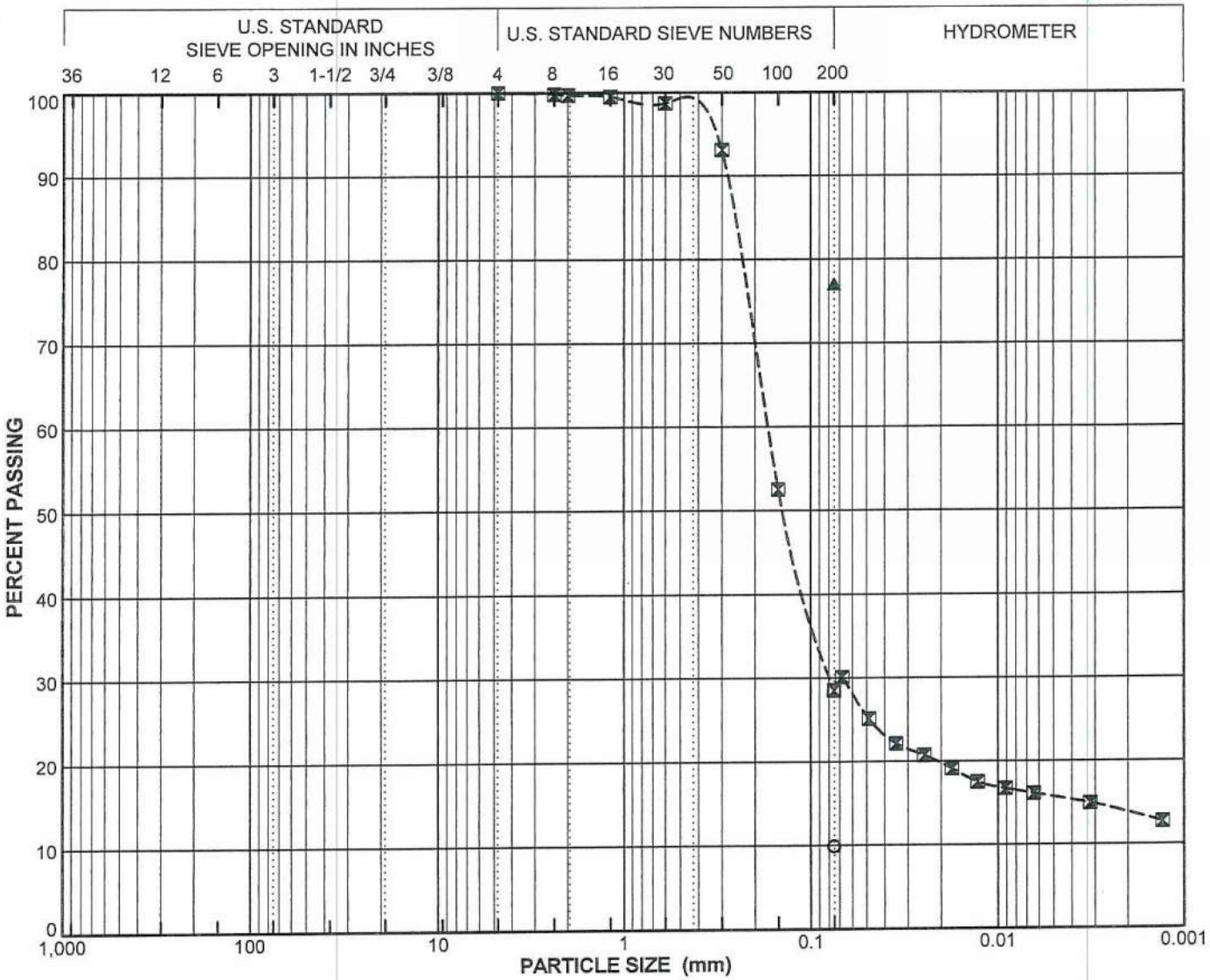
(FRM001a Rev.4)

Project No. 11050-02

Project Name: CSD / District Office

NMG

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

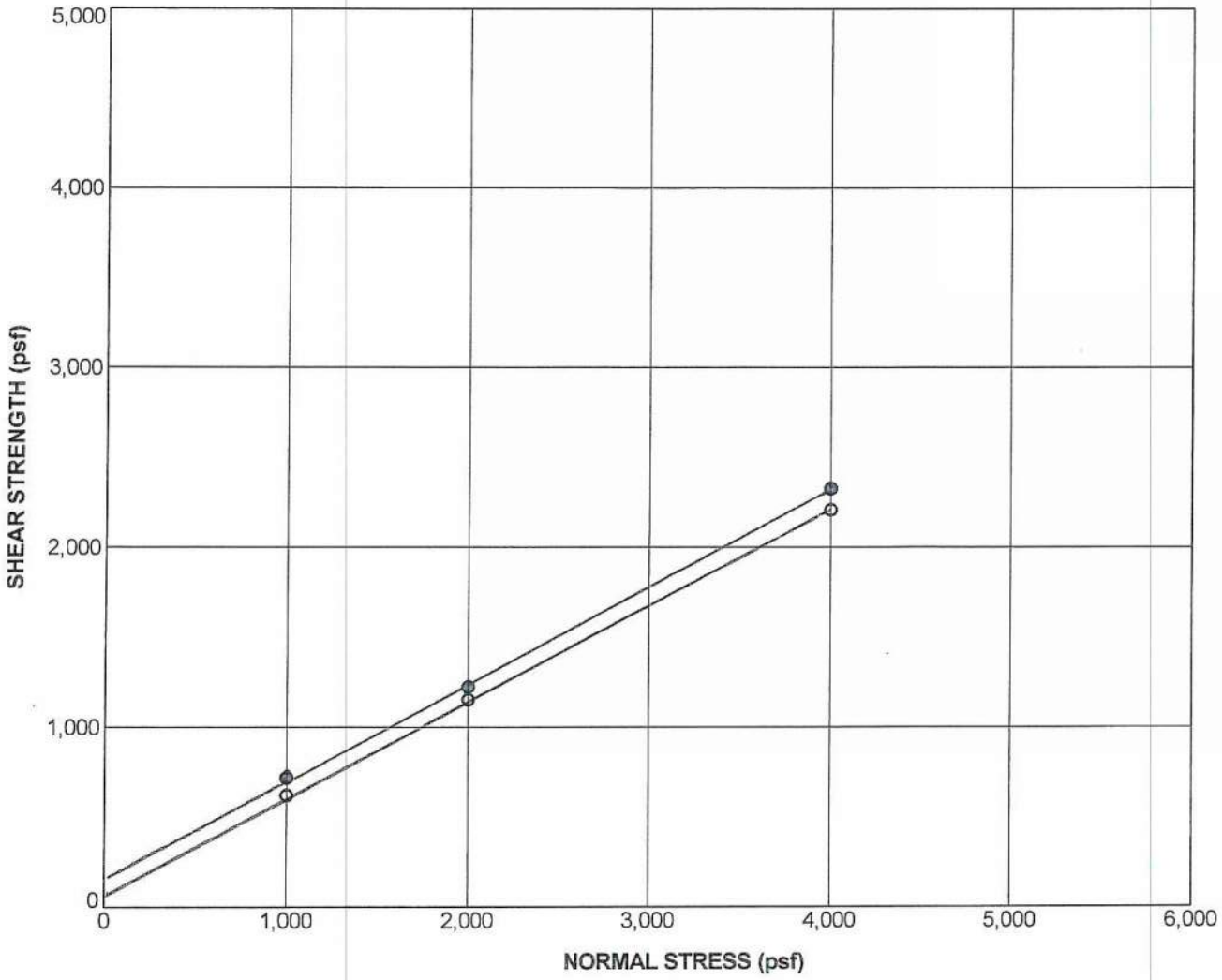


Symbol	Boring Number	Sample Number	Depth (feet)	Field Moisture (%)	LL	PI	Activity PI/-2μ	C_u	C_c	Passing No. 200 Sieve (%)	Passing 2μ (%)	USCS
O	H-1	D-5	15.0	28						10		SP
⊠	H-2	B-1	1.0	8	NP	NP				29	14	SM
▲	H-2	D-4	10.0	32						77		CL

PARTICLE SIZE DISTRIBUTION

CSD/ District Office
Cypress, California
PROJECT NO. 11050-02

NMG Geotechnical, Inc.



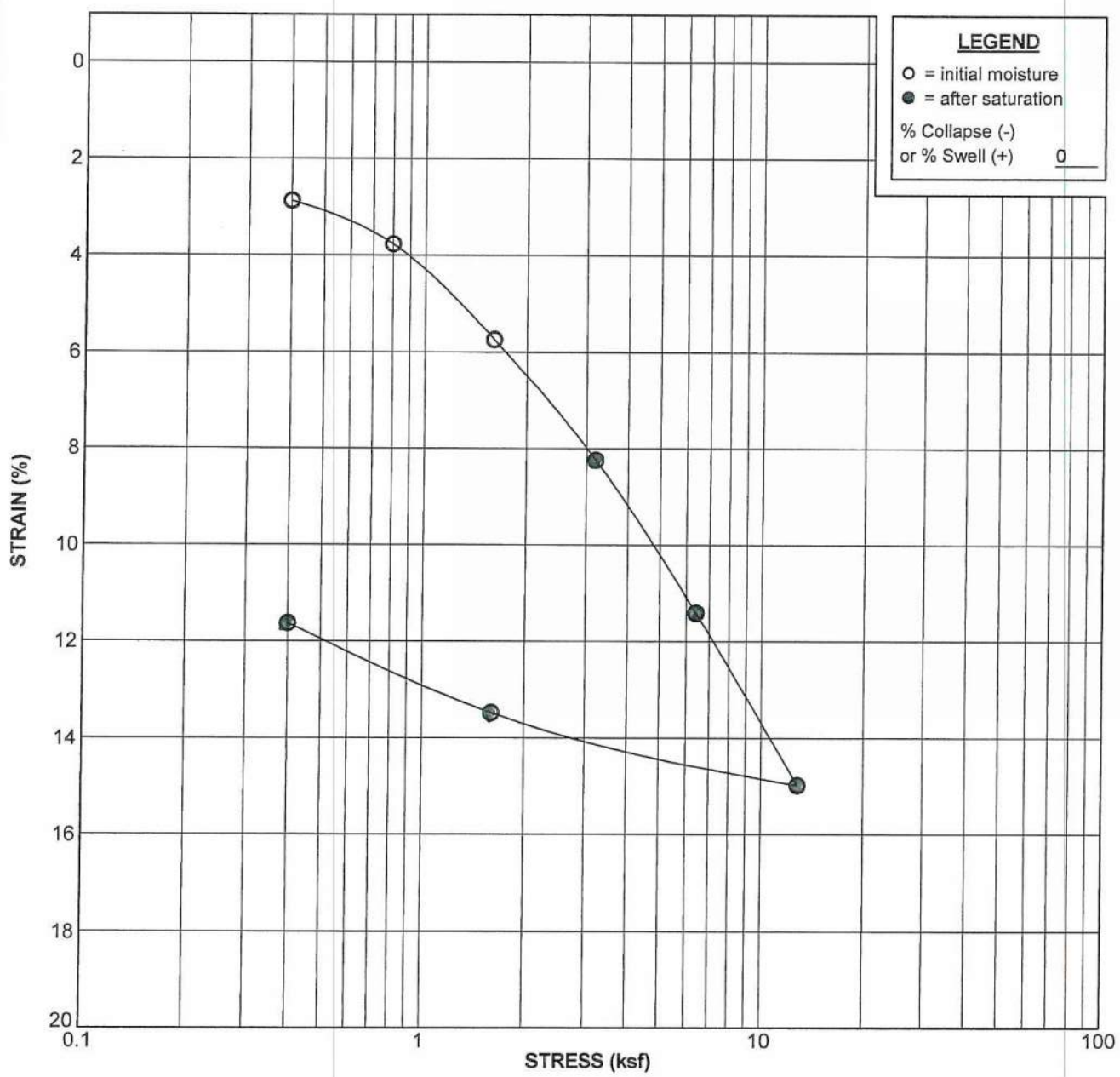
Boring No. H-2		Sample No. D-2		Depth: 5.0 ft	
Sample Description:	(Qal) Dark gray sandy SILT				
Liquid Limit:		Plasticity Index:		Percent Passing No. 200 Sieve:	
Moisture Content (%):	39.4	Dry Density (pcf):	86.9	Degree of Saturation (%):	100
Sample Type:	Undisturbed	Rate of Shear (in./min.):	0.005		

SHEAR STRENGTH PARAMETERS		
Parameter	Peak ●	Ultimate ○
Cohesion (psf)	180	80
Friction Angle (degrees)	28	27.0

DIRECT SHEAR TEST RESULTS

CSD/ District Office
Cypress, California
PROJECT NO. 11050-02

NMG Geotechnical, Inc.



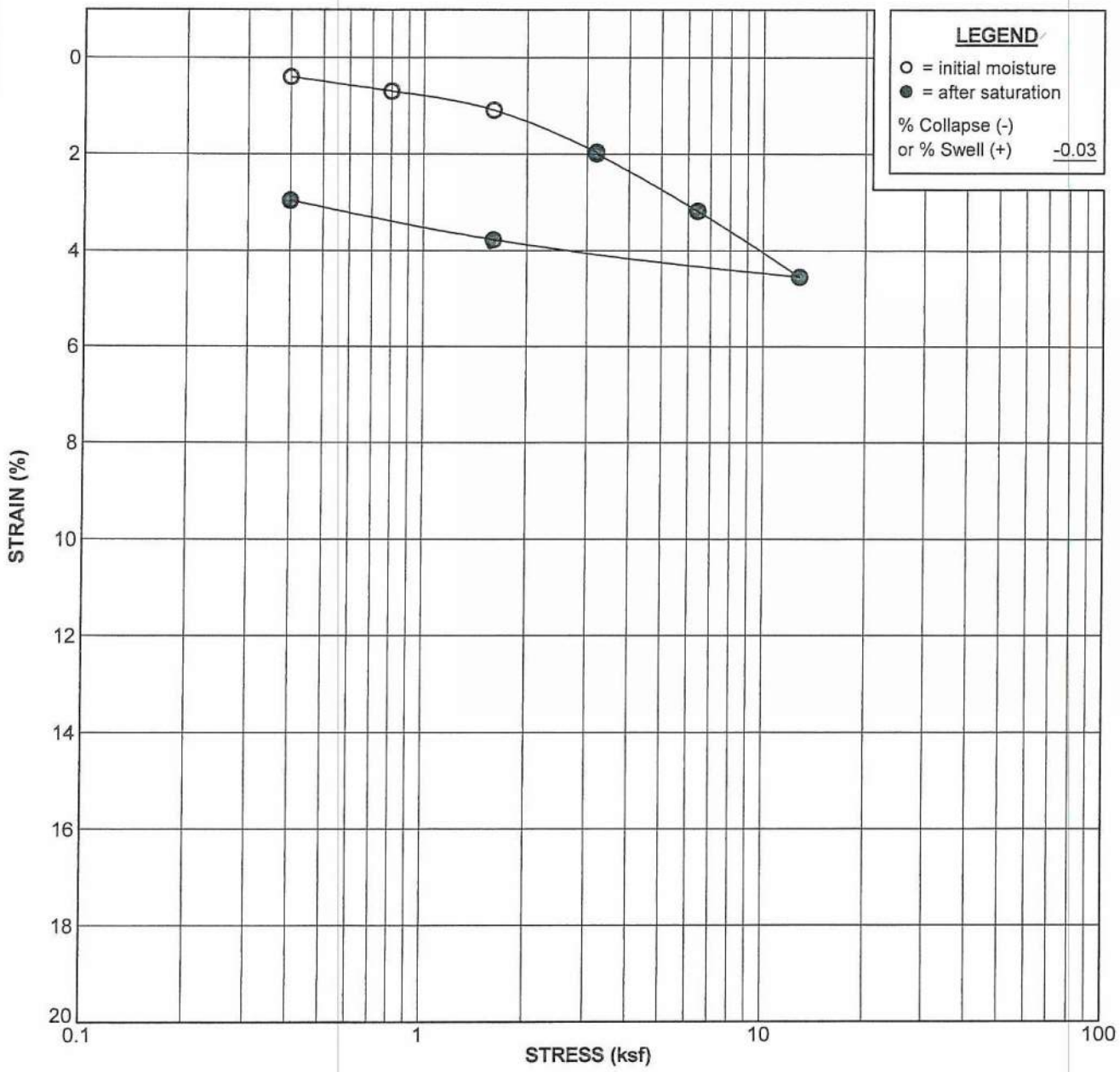
Boring No. H-1	Sample No. D-3	Depth: 7.5 ft
Sample Description:	(Qal) Grayish brown silty SAND	
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve:

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	41.5	79.1	100.9	1.091
Final	34.2	88.3	103.8	0.873

CONSOLIDATION TEST RESULTS

CSD/ District Office
Cypress, California
PROJECT NO. 11050-02

NMG Geotechnical, Inc.



Boring No. H-2	Sample No. D-2	Depth: 5.0 ft
Sample Description:	(Qal) Dark gray sandy SILT	
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve:

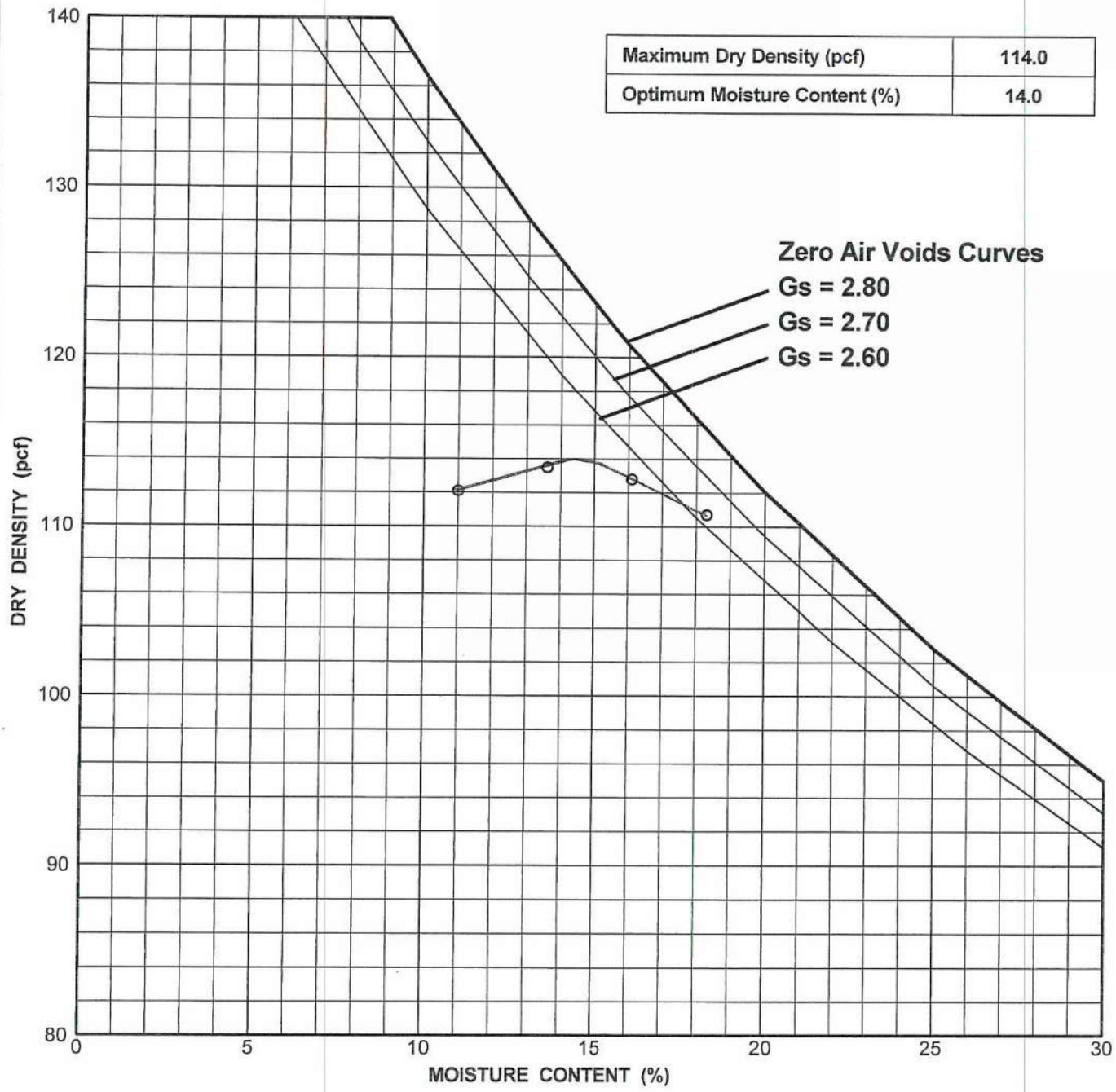
Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	27.0	90.8	74.1	1.130
Final	31.0	93.5	89.9	1.069

CONSOLIDATION TEST RESULTS

CSD/ District Office
Cypress, California
PROJECT NO. 11050-02

NMG Geotechnical, Inc.

Maximum Dry Density (pcf)	114.0
Optimum Moisture Content (%)	14.0

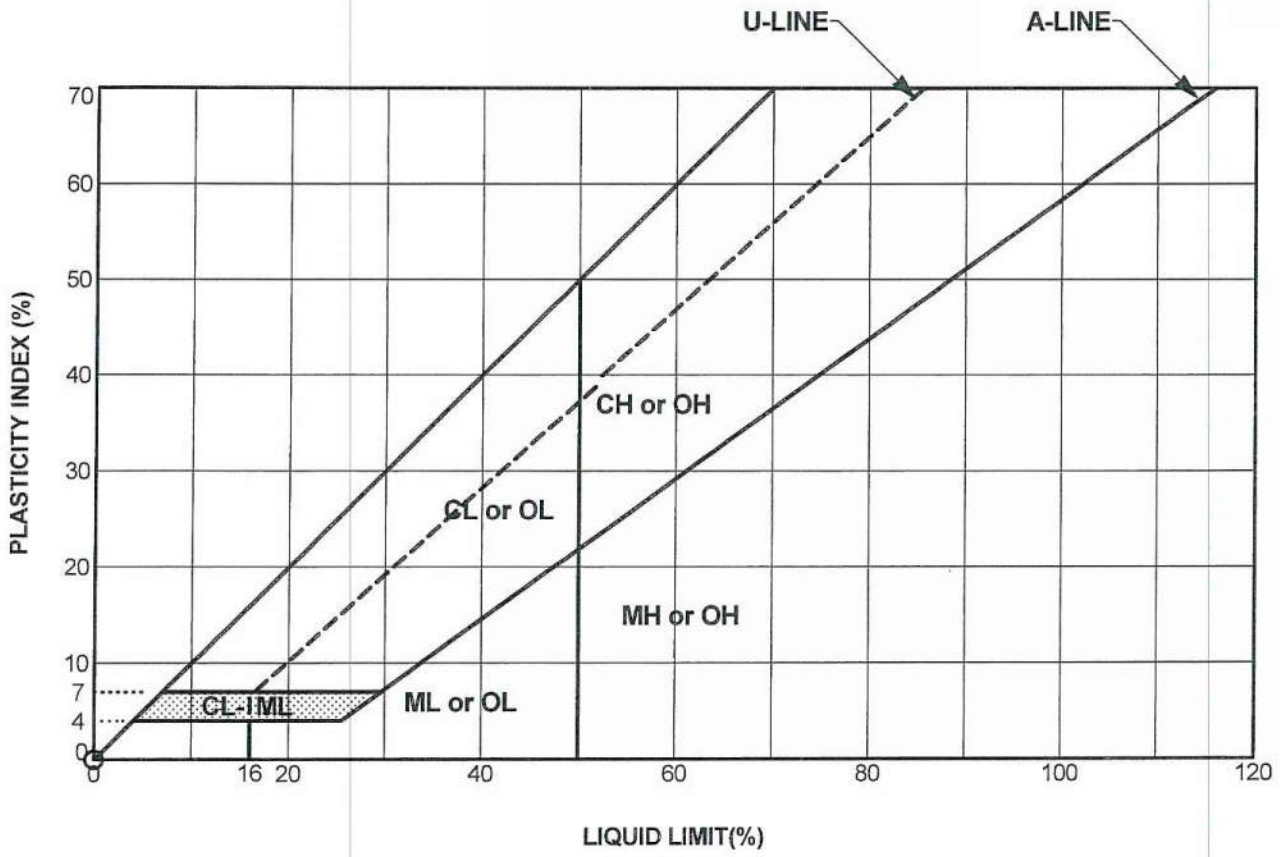


Boring No. H-2		**Sample No. B-1**		**Depth: 1.0 ft**	
Sample Description:	(Qal) Pale brown silty SAND				
Liquid Limit:	NP	**Plasticity Index:**	NP	**Percent Passing No. 200 Sieve:**	29
Comments:	1557A				

COMPACTION TEST RESULTS

CSD/ District Office
Cypress, California
PROJECT NO. 11050-02

NMG Geotechnical, Inc.



Symbol	Boring Number	Depth (feet)	Sample Number	Passing No. 200 Sieve (%)	LL	PI	USCS	Description
O	H-2	1.0	B-1	29	NP	NP	SM	(Qal) Pale brown silty SAND

PLASTICITY CHART

CSD/ District Office
Cypress, California
PROJECT NO. 11050-02

NMG Geotechnical, Inc.

R-VALUE TEST DATA CTM 301

Project:	C.S.D./ District Office	Project No:	11050-02	Date:	10/18/2011
Boring Trench No:	H-2	Sample No:	B-1	Sample Depth:	0-5'
Field Description:	SM				
Lab Description:	Olive brown clayey SILT (ML)				

Specimen Number	1	2	3	4
Mold Number	7	8	9	
Water Adjustment (g)	+70	+80	+75	
Compactor Pressure (psi)	165	145	155	
Exudation Pressure (psi)	427	203	359	
Gross Weight (g)	3187.2	3175.8	3186.2	
Mold Tare (g)	2132.2	2118.9	2129.8	
Wet Weight (g)	1055	1056.9	1056.4	0
Sample Height (in)	2.51	2.52	2.51	
Initial Dial Reading	0.0725	0.0356	0.0424	
Final Dial Reading	0.0736	0.0363	0.0432	
Expansion (in $x10^{-4}$)	11	7	8	0
Stability(psi) at 2,000 lbs (160 psi)	24 | 39	26 | 46	25 | 40	|
Turns Displacement	3.5	3.92	3.84	
R-Value Uncorrected	69	61	66	#DIV/0!
R-Value Corrected	69	61	66	
Moisture Content (%)	13.3	13.9	13.6	#DIV/0!
Dry Density (pcf)	112.4	111.6	112.3	#DIV/0!
Assumed Traffic Index	4.0	4.0	4.0	4.0
G.E. by Stability	0.32	0.40	0.35	1.02
G.E. by Expansion	0.37	0.23	0.27	0.00
Gf	1.25			

Moisture Content				
Dish No.	A	B	C	
Weight of Moist Soil and Dish (g)	260.6	243.2	259	
Weight of Dry Soil and Dish (g)	235.8	219.7	234	
Water Loss (g)	24.8	23.5	25	0
Weight of Dish (g)	49.3	50.1	50	
Dry Soil (g)	186.5	169.6	184	0
Moisture Content (%)	13.3	13.9	13.6	#DIV/0!

R-Value by Exudation = 64

R-Value by Expansion = 71

R-Value at Equilibrium = 64 by Exudation

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301

Remarks:

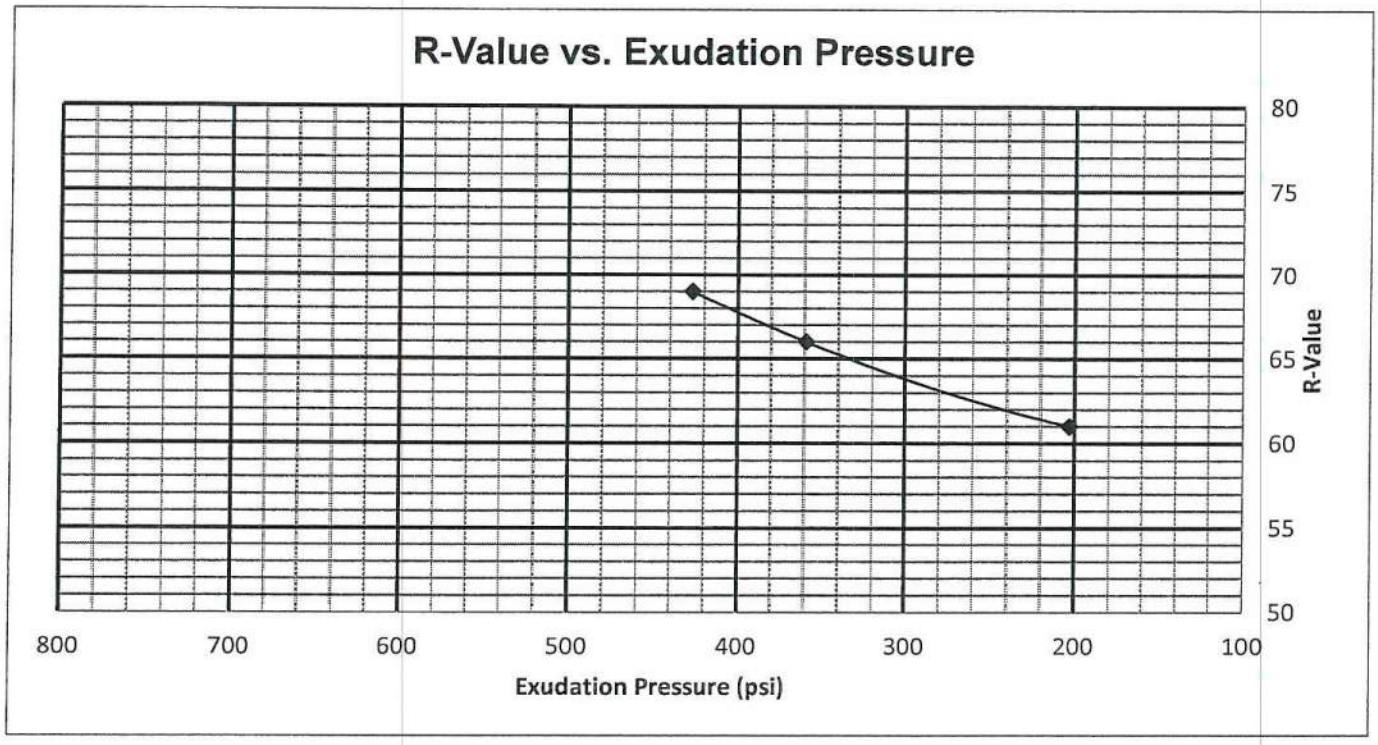
Set up by: Run by: GEH/MPD

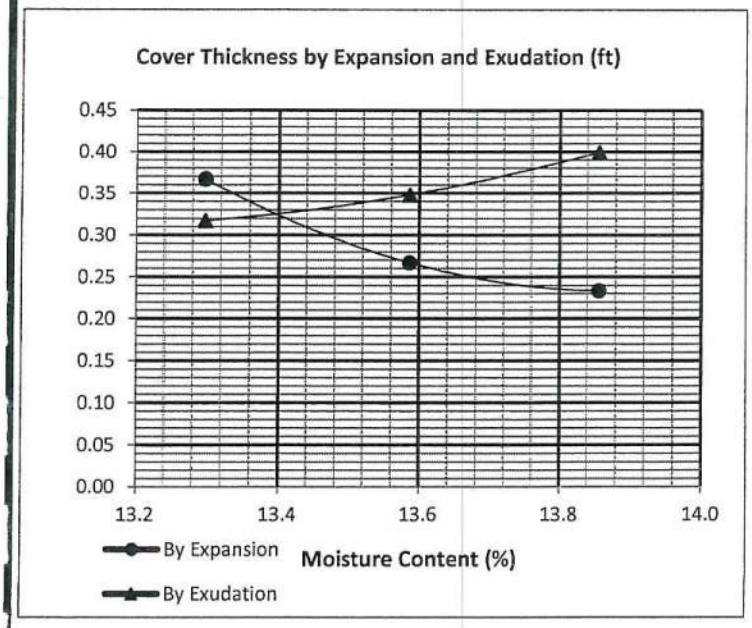
Calculated by: Checked by: Date Completed: 10/19/2011

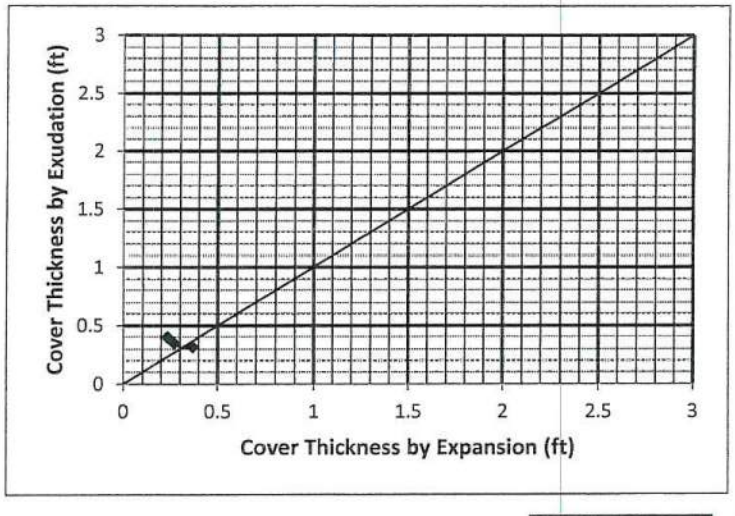
NMG Geotechnical, Inc.

R-VALUE GRAPHICAL PRESENTATION

Project:	C.S.D./ District Office	Project No:	11050-02	Date:	10/18/2011
Boring Trench No:	H-2	Sample No:	B-1	Sample Depth:	0-5'
Field Description:	SM				
Lab Description:	Olive brown clayey SILT (ML)				







Cover Thickness (ft) = 0.3

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301

Remarks:

Set up by: Run by:

Calculated by: Checked by: Date Completed:

NMG Geotechnical, Inc.

Table 1 - Laboratory Tests on Soil Samples

NMG Geotechnical, Inc.
HDR|Schiff #11-1071LAB
21-Oct-11

Sample ID			Cawthorn H-1, B-1 @ 0-5' SM	District Office H-2, B-1 @ 0-5' SM, ML	Damron H-1, B-1 @ 0-5' SM, ML
Resistivity		**Units**			
as-received		ohm-cm	2,440	13,200	25,200
saturated		ohm-cm	76	2,080	2,320
pH			8.1	8.2	8.0
Electrical Conductivity		mS/cm	1.76	0.21	0.13
Chemical Analyses					
Cations					
calcium	Ca^{2+}	mg/kg	167	53	72
magnesium	Mg^{2+}	mg/kg	93	11	18
sodium	Na^{1+}	mg/kg	1,561	139	70
potassium	K^{1+}	mg/kg	128	147	40
Anions					
carbonate	CO_3^{2-}	mg/kg	ND	ND	ND
bicarbonate	HCO_3^{1-}	mg/kg	296	479	375
fluoride	F^{1-}	mg/kg	6.6	5.5	8.3
chloride	Cl^{1-}	mg/kg	685	21	11
sulfate	SO_4^{2-}	mg/kg	2,086	58	36
phosphate	PO_4^{3-}	mg/kg	ND	72	0.9
Other Tests					
ammonium	NH_4^{1+}	mg/kg	ND	4.0	ND
nitrate	NO_3^{1-}	mg/kg	178	28	13
sulfide	S^{2-}	qual	na	na	na
Redox		mV	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.
Redox = oxidation-reduction potential in millivolts
ND = not detected
na = not analyzed

APPENDIX B

BORING LOGS BY GEOTEK

Updated Geotechnical Evaluation
Orange Avenue Seniors, Cypress, California
Project No. 2573-CR

GEOTEK

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRW
PROJECT NAME	Cypress	**DRILL METHOD:**	Hollow Stem Auger	**OPERATOR:**	Ish
PROJECT NO.:	1763-CR	**HAMMER:**	140/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	9/25/2017

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	BORING NO.: B-1 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					UNDOCUMENTED FILL			
		8 11 13		SM	Silty f-m SAND, brown, moist, medium dense	13.0	97.0	DS, HC, SA
					ALLUVIUM			
5		3 2 1		SM	Silty f SAND, gray to grayish brown, very moist, loose approximately 23% fines	30.0	92.0	
10		1 3 7			No recovery in sampler			
		1 2 4		ML	F sandy SILT, brownish gray, very moist, loose			
					BORING TERMINATED AT 13 FEET			
15					No groundwater encountered Boring backfilled with soil cuttings			
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRW
PROJECT NAME	Cypress	**DRILL METHOD:**	Hollow Stem Auger	**OPERATOR:**	Ish
PROJECT NO.:	1763-CR	**HAMMER:**	140/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	9/25/2017

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	**BORING NO.: B-2** / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				SM	**UNDOCUMENTED FILL** Silty f-m SAND, brown, moist			
		10 13 16		SM	**ALLUVIUM** Silty f SAND, brownish gray, moist, medium dense	14.0	101	
5								
		3 3 4			No recovery in sampler			
10		1 1 2		ML	F sandy SILT, gray, very moist, loose			
					BORING TERMINATED AT 11.5 FEET No groundwater encountered Boring backfilled with soil cuttings			
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRW
PROJECT NAME	Cypress	**DRILL METHOD:**	Hollow Stem Auger	**OPERATOR:**	Ish
PROJECT NO.:	1763-CR	**HAMMER:**	140/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	9/25/2017

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	BORING NO.: B-3 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
		11 16 17			**UNDOCUMENTED FILL** Silty f-m SAND, brown to dark brown, moist, medium dense	11.0	122.0	
5		5 7 8		SM	**ALLUVIUM** Silty f SAND, brownish gray, moist, loose approximately 15% fines	24.0	92.0	SA
10		1 1 1		ML	SILT, gray, very moist, loose	36.0	86.0	HC
					BORING TERMINATED AT 11.5 FEET No groundwater encountered Boring backfilled with soil cuttings			
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRW
PROJECT NAME	Cypress	**DRILL METHOD:**	Hollow Stem Auger	**OPERATOR:**	Ish
PROJECT NO.:	1763-CR	**HAMMER:**	140/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	9/25/2017

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	BORING NO.: B-4 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				SM	**UNDOCUMENTED FILL** Silty f-m SAND, brown, moist			
5		3 4 5		SM	**ALLUVIUM** Silty f SAND to sandy SILT, brownish gray, moist, loose	15.0	102	HC
		2 1 2		ML	F sandy SILT, gray, very moist, loose	32.0	91	
10					**BORING TERMINATED AT 11.5 FEET** No groundwater encountered Boring backfilled with soil cuttings			
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRW
PROJECT NAME	Cypress	**DRILL METHOD:**	Hollow Stem Auger	**OPERATOR:**	Ish
PROJECT NO.:	1763-CR	**HAMMER:**	140/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	9/25/2017

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	**BORING NO.: B-5** / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					UNDOCUMENTED FILL			
		8 6 6			Silty f-m SAND, brown, moist, loose, trace fine gravel	8.0	107.0	
					ALLUVIUM			
5		5 9 15		ML	F-c SAND, light gray, moist, medium dense	8.0	101.0	
10		2 2 4			No recovery in sampler			
		1 1 2		ML	F sandy SILT, gray, very moist, loose			
					BORING TERMINATED AT 13 FEET			
15					No groundwater encountered Boring backfilled with soil cuttings			
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	JE
PROJECT NAME:	9470 Moody Street	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Ish
PROJECT NO.:	2573-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	12/8/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	**BORING NO.: B-6** / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					4" Asphalt over 3" Base **ALLUVIUM:**			
		7 12 15		SM	Silty f-m SAND, light brown to brown, moist, medium dense	10.2	93.5	
5		5 3 3		ML	F-m sandy SILT, gray to grayish brown, wet, loose	28.9	93.7	HC
					BORING TERMINATED AT 7 FEET No groundwater encountered Boring backfilled with soil cuttings and patched with AC			
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	JE
PROJECT NAME:	9470 Moody Street	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Ish
PROJECT NO.:	2573-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	12/8/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	**BORING NO.: B-7** / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					4" Asphalt over 4" Base			
					ALLUVIUM:			MD, EI, SR
		10 12 12		SM	F-m SAND with silt, light grayish brown to brown, moist, medium dense	10.6	108.6	
		5 7 11			becomes very moist	24.2	100.1	
5		4 3 3		SM	Silty f-m SAND, dark brown to brown, very moist, loose.	37.8	84.3	HC
					BORING TERMINATED AT 8 FEET			
					No groundwater encountered Boring backfilled with soil cuttings and patched with AC			
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	JE
PROJECT NAME:	9470 Moody Street	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Ish
PROJECT NO.:	2573-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	12/8/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	**BORING NO.: B-8** / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					4" Asphalt over 4" Base			
					ALLUVIUM:			
		7 10 13		SM	F-m SAND with silt, light brown, moist, medium dense	12.3	114.2	
5		7 9 11		SM	Silty f-m SAND, brown to dark brown, very moist, medium dense	28.3	82.7	
					BORING TERMINATED AT 7 FEET			
					No groundwater encountered			
					Boring backfilled with soil cuttings and patched with AC			
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	HC= Consolidation	MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	JE
PROJECT NAME:	9470 Moody Street	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Ish
PROJECT NO.:	2573-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	12/8/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	BORING NO.: B-9 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					3" Asphalt over 4" Base			
					ALLUVIUM:			
	■	5 11 12		SM	F-m SAND with silt, light brown, moist, medium dense	12.6	114.2	
	■	7 10 11			same as above, becomes very moist	27.7	85.5	
5	■	5 5 6		SP	F-m SAND, light brown to brown, very moist, loose	24.6	85.9	
					BORING TERMINATED AT 7 FEET			
					No groundwater encountered Boring backfilled with soil cuttings and patched with AC			
10								
15								
20								
25								
30								

LEGEND

Sample type: ■ ---Ring ■ ---SPT ⧸ ---Small Bulk ☒ ---Large Bulk □ ---No Recovery ▽ ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Melia Homes	**DRILLER:**	2R Drilling	**LOGGED BY:**	JE
PROJECT NAME:	9470 Moody Street	**DRILL METHOD:**	8" Hollow Stem	**OPERATOR:**	Ish
PROJECT NO.:	2573-CR	**HAMMER:**	Auto 140#/30"	**RIG TYPE:**	CME 75
LOCATION:	See Exploration Location Map			**DATE:**	12/8/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	**BORING NO.: B-10** / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					4" Asphalt over 4" Base			
					ALLUVIUM:			
		5 9 13		SM	F-c SAND with silt, light brown, very moist, medium dense	15.5	96.8	
5		3 4 4		SM	Silty f-m SAND, brown to dark brown, very moist, loose	34.4	87.8	
					BORING TERMINATED AT 7 FEET			
					No groundwater encountered Boring backfilled with soil cuttings and patched with AC			
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

A - FIELD TESTING AND SAMPLING PROCEDURES

The Standard Penetration Test (SPT)

The SPT is performed in accordance with ASTM Test Method D 1586. The SPT sampler is typically driven into the ground 12 or 18 inches with a 140-pound hammer free falling from a height of 30 inches. Blow counts are recorded for every 6 inches of penetration as indicated on the log of boring. The split-barrel sampler has an external diameter of 2 inches and an unlined internal diameter of 1-3/8 inches. The samples of earth materials collected in the sampler are typically classified in the field, bagged, sealed and transported to the laboratory for further testing.

The Modified Split-Barrel Sampler (Ring)

The ring sampler is driven into the ground in accordance with ASTM Test Method D 3550. The sampler, with an external diameter of 3.0 inches, is lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sampler is typically driven into the ground 12 or 18 inches with a 140-pound hammer free falling from a height of 30 inches. Blow counts are recorded for every 6 inches of penetration as indicated on the log of boring. The samples are removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

Bulk Samples (Large)

These samples are normally large bags of earth materials over 20 pounds in weight collected from the field by means of hand digging or exploratory cuttings.

Bulk Samples (Small)

These are plastic bag samples which are normally airtight and contain less than 5 pounds in weight of earth materials collected from the field by means of hand digging or exploratory cuttings. These samples are primarily used for determining natural moisture content and classification indices.

B – BORING LOG LEGEND

The following abbreviations and symbols often appear in the classification and description of soil and rock on the logs of borings:

SOILS

USCS	Unified Soil Classification System
f-c	Fine to coarse
f-m	Fine to medium

GEOLOGIC

B: Attitudes	Bedding: strike/dip
J: Attitudes	Joint: strike/dip
C: Contact line	
……..	Dashed line denotes USCS material change
———	Solid Line denotes unit / formational change
———	Thick solid line denotes end of boring

(Additional denotations and symbols are provided on the log of borings)

APPENDIX C

LABORATORY TEST RESULTS

Updated Geotechnical Evaluation
Orange Avenue Seniors, Cypress, California
Project No. 2573-CR

GEOTEK

SUMMARY OF LABORATORY TESTING

Classification
Soils were classified visually in general accordance with the Unified Soil Classification System (ASTM Test Method D 2487). The soil classifications are shown on the logs of exploratory borings in Appendix B.

In Situ Moisture Content and Unit Weight
The field moisture content was measured in the laboratory on selected samples collected during the field investigation. The field moisture content is determined as a percentage of the dry unit weight. The dry density was measured in the laboratory on selected ring samples. The results are shown on the logs of exploratory borings in Appendix B.

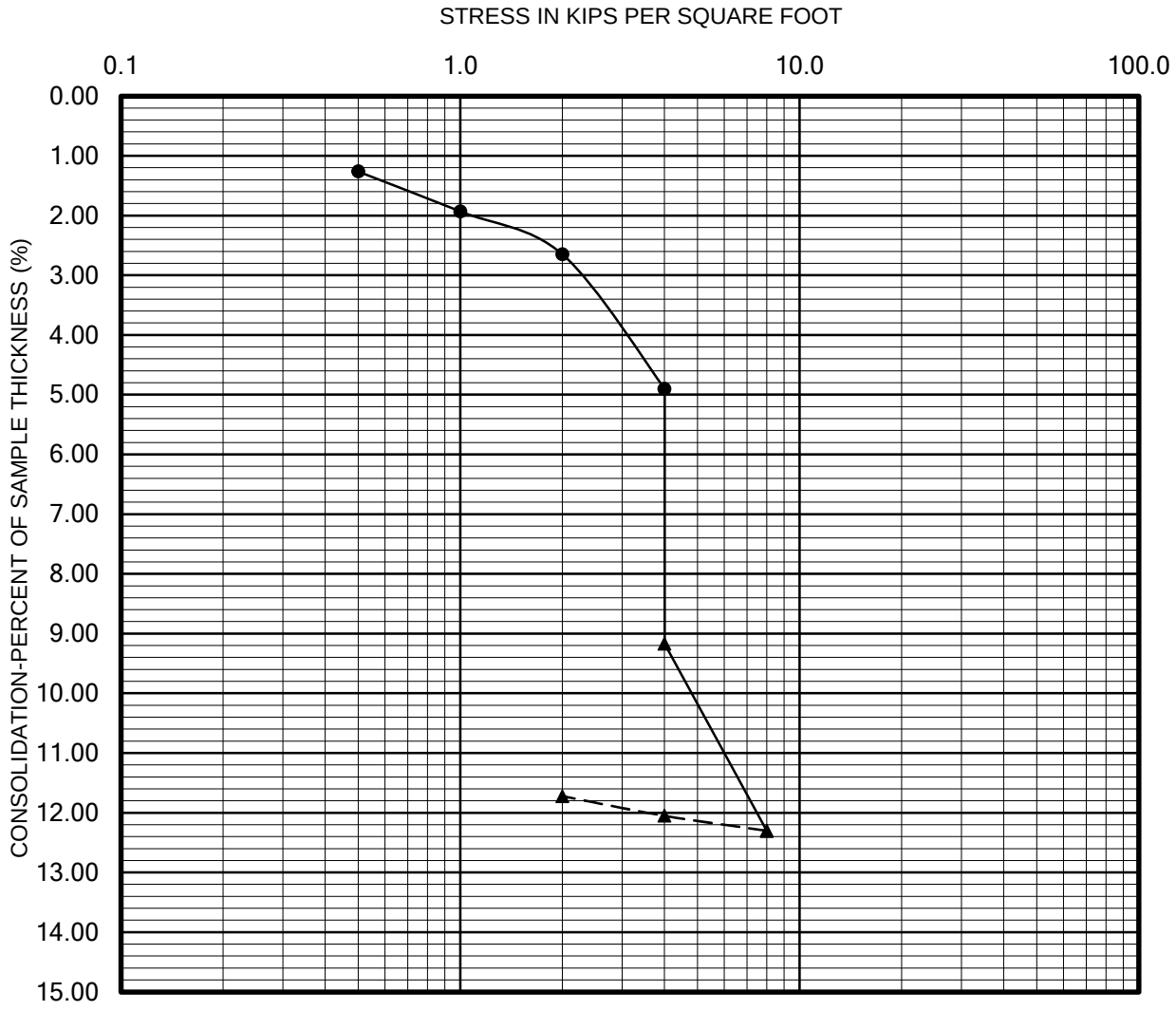
Consolidation/Collapse
Consolidation/collapse testing was performed on selected samples of the site soils according to ASTM Test Method D 2435 and ASTM D4546, respectively. The results of these tests are presented herein.

Direct Shear
Direct shear testing was performed on remolded samples of the surficial soils according to ASTM Test Method D 3080. The results of these tests are presented herein.

Moisture-Density Relationship
Laboratory testing was performed on two samples collected during the subsurface exploration. The laboratory maximum dry density and optimum moisture content for the soil types was determined in general accordance with test method ASTM Test Procedure D 1557. The results are included herein.

Materials Finer Than the No. 200 Sieve
A #200 sieve wash was performed on selected samples of the soils according to ASTM Test Method D 1140. The results of these tests are presented herein.

Sulfate Content, Resistivity and Chloride Content
Testing to determine the water-soluble sulfate content, resistivity testing and the chloride content was performed by others. The test results are presented herein



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

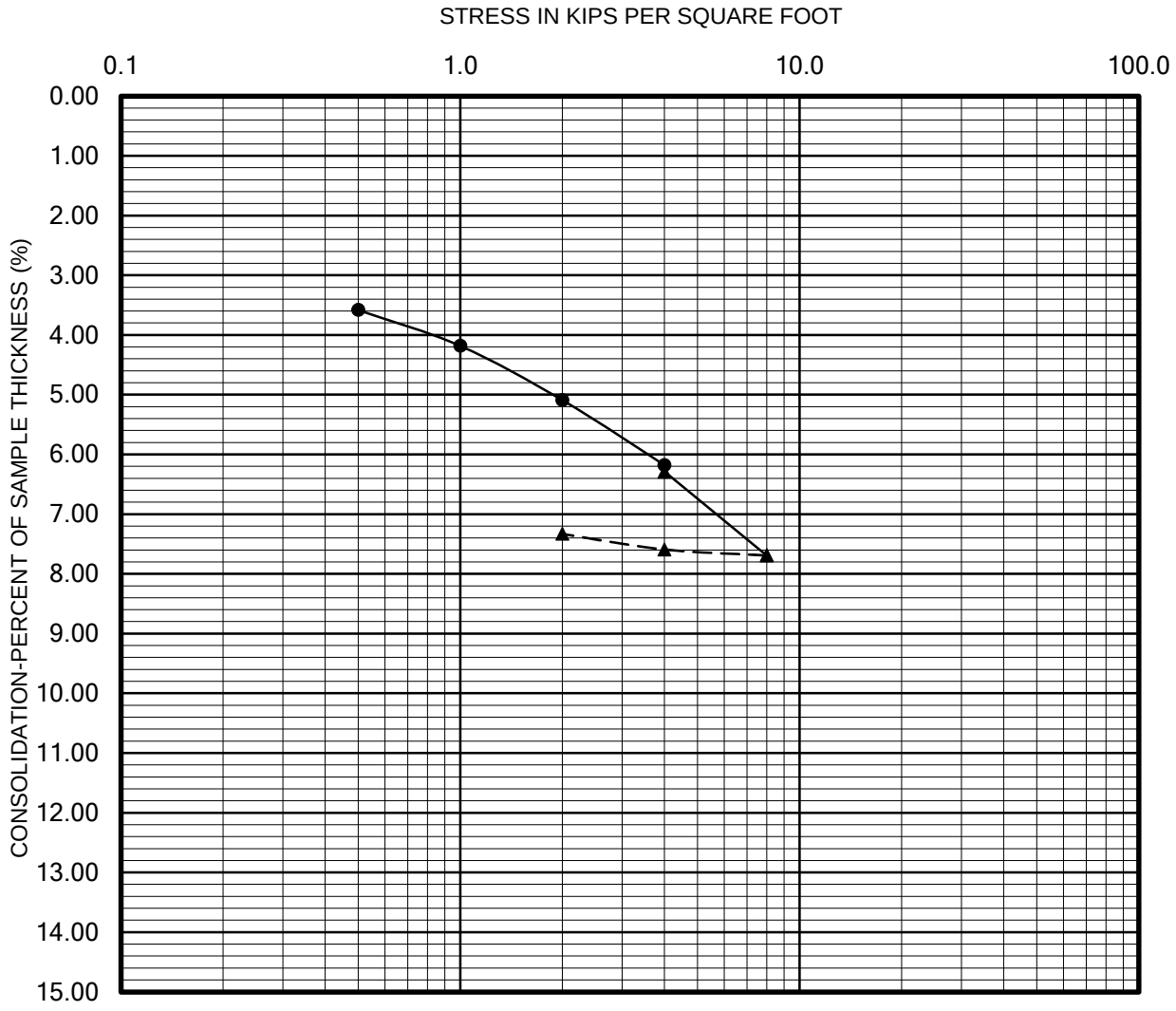
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

GEOTEK

CONSOLIDATION REPORT

B-1 @ 5 ft

CHECKED BY:	Lab: DI
PROJECT NO.: 1763-CR	Date: 10/4/2017



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

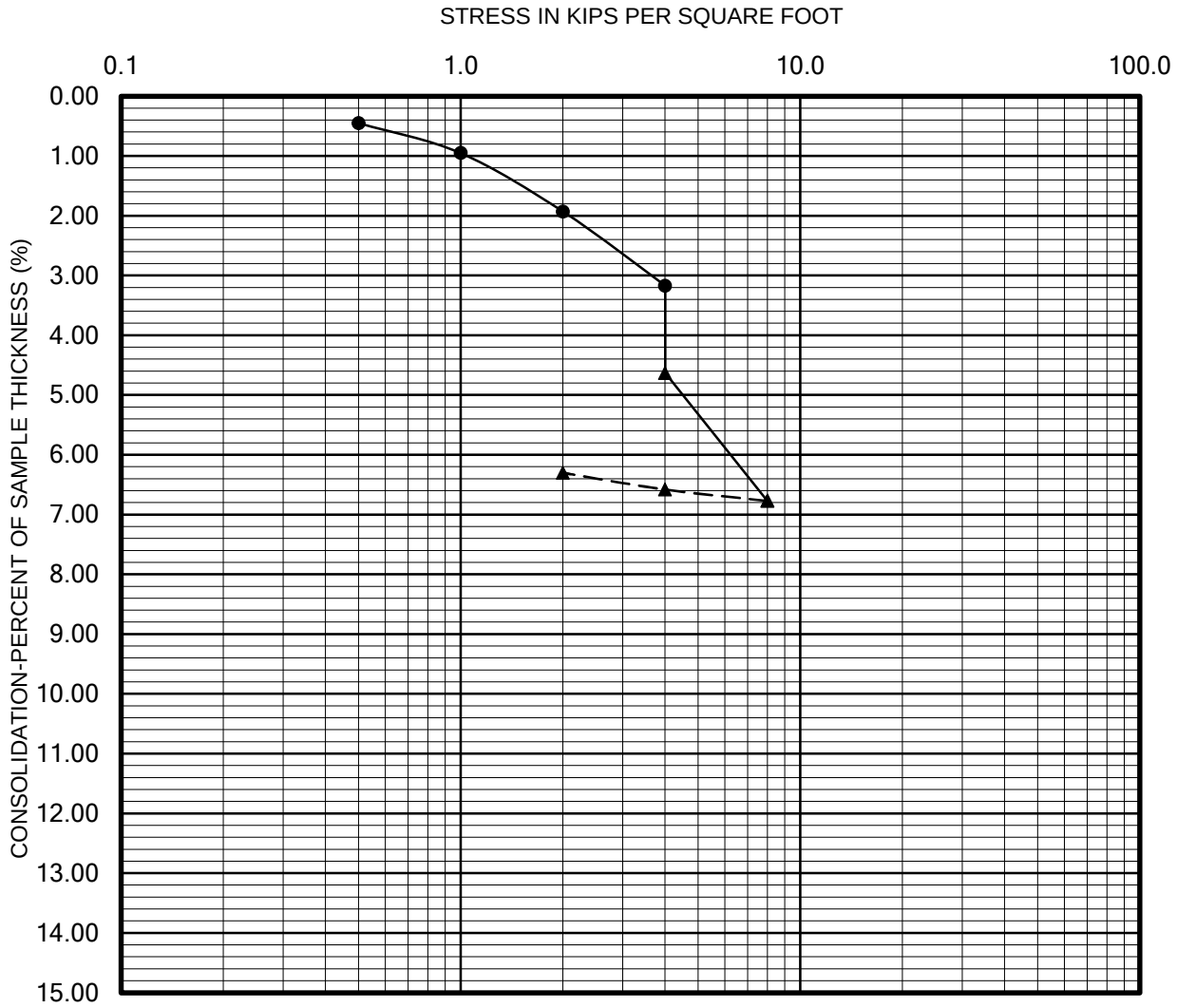
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

GEOTEK

CONSOLIDATION REPORT

B-3 @ 10ft

CHECKED BY:	Lab: DI
PROJECT NO.: 1763-CR	Date: 10/4/2017



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

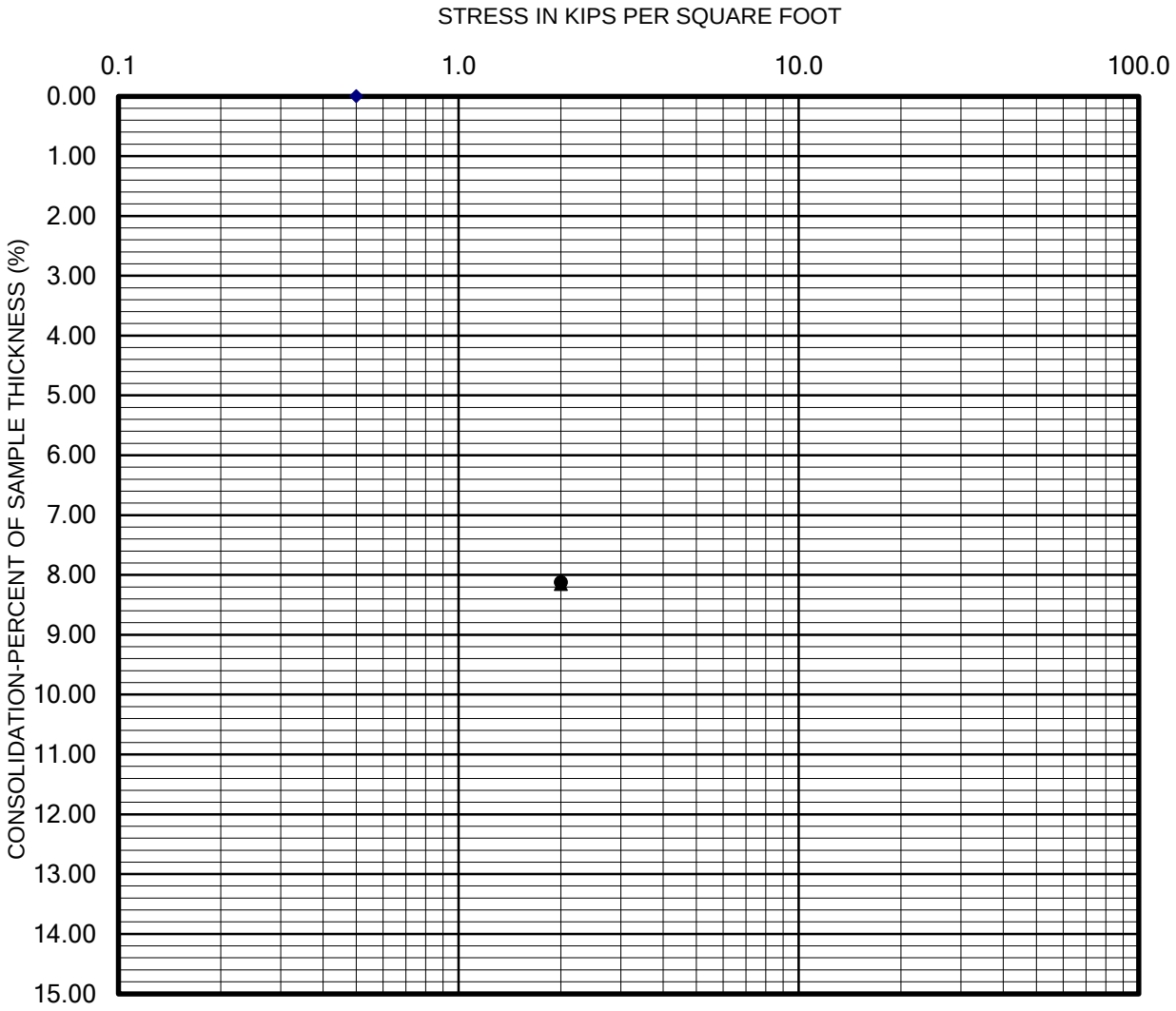
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

GEOTEK

CONSOLIDATION REPORT

B-4 @ 3 ft

CHECKED BY:	Lab: DI
PROJECT NO.: 1763-CR	Date: 10/4/2017



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

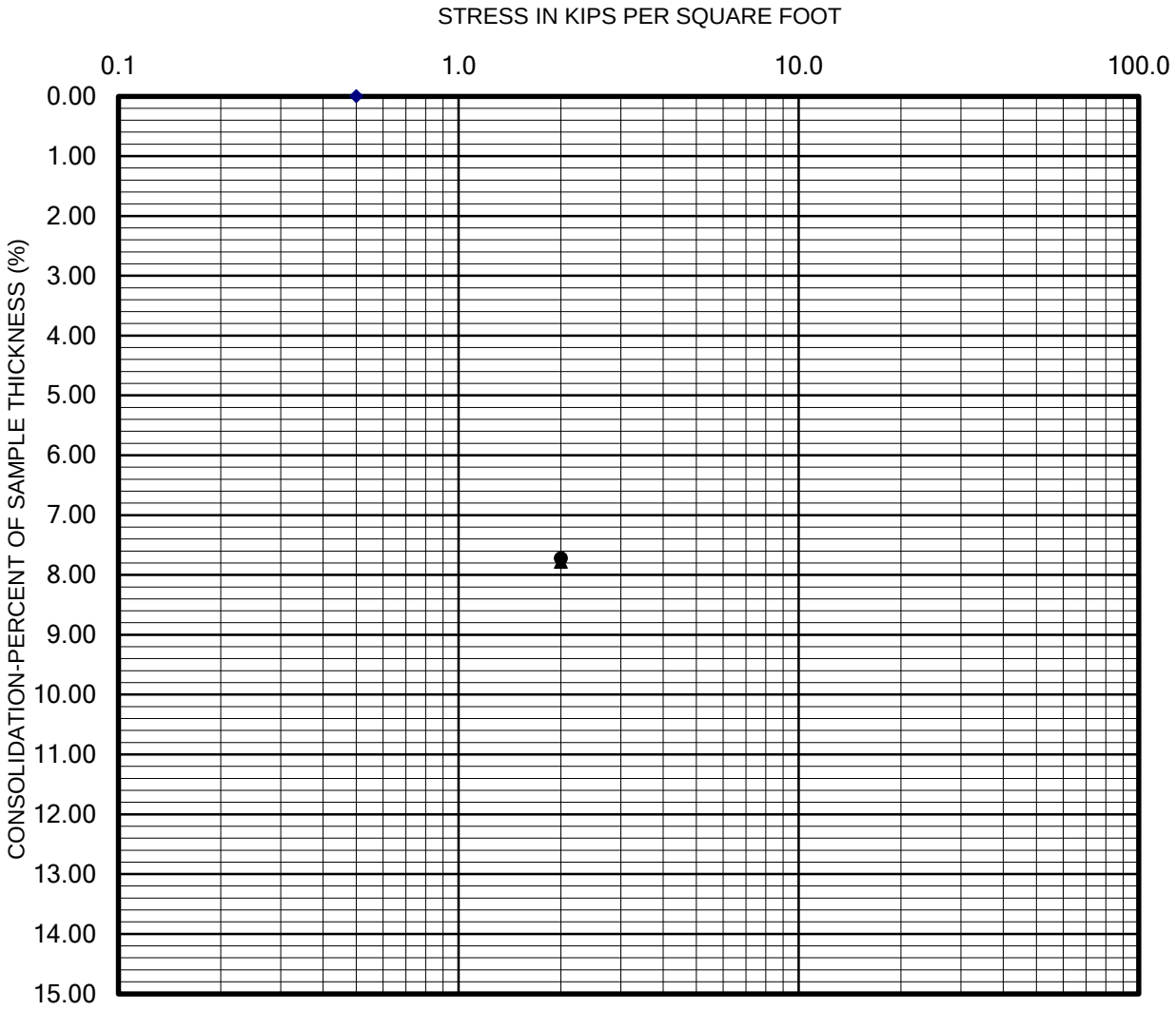
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

GEOTEK

COLLAPSE REPORT

Sample: B-6 @ 5 feet

CHECKED BY: DA	Lab: Corona
PROJECT NO.: 2573-CR	Date: 12/29/20



Seating Cycle
Loading Prior to Inundation
Loading After Inundation
Rebound Cycle

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

GEOTEK

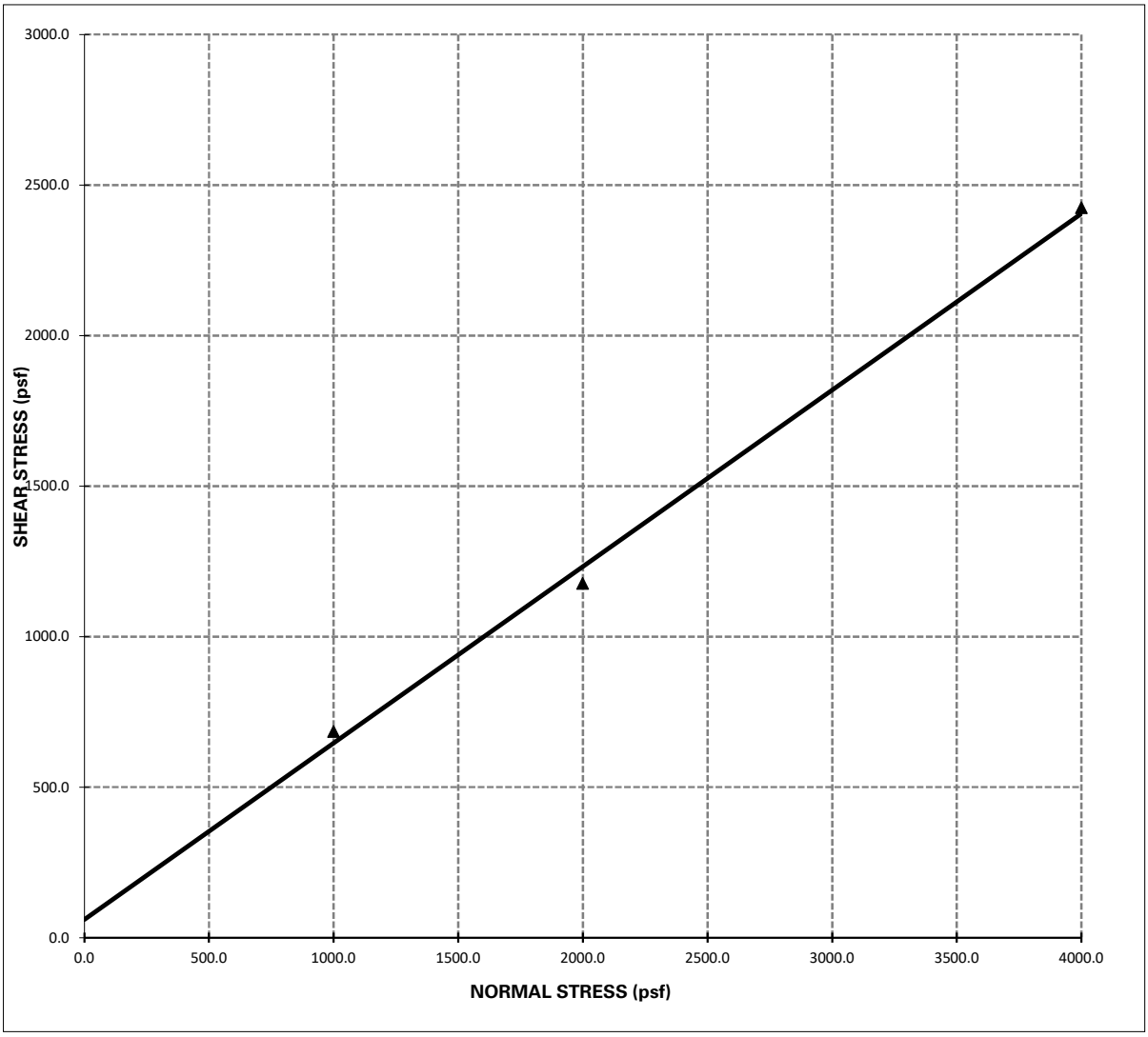
COLLAPSE REPORT

Sample: B-7 @ 5 feet

CHECKED BY: DA	Lab: Corona
PROJECT NO.: 2573-CR	Date: 12/29/20

DIRECT SHEAR TEST

Project Name:		***Sample Location:***	B-1 @ 1 - 5 ft
Project Number:	1763-CR	***Date Tested:***	10/4/2017



Shear Strength: Φ = **30.4** ° , **C = 60.00 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

2 - The above reflect direct shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

GEOTEK

MOISTURE/DENSITY RELATIONSHIP

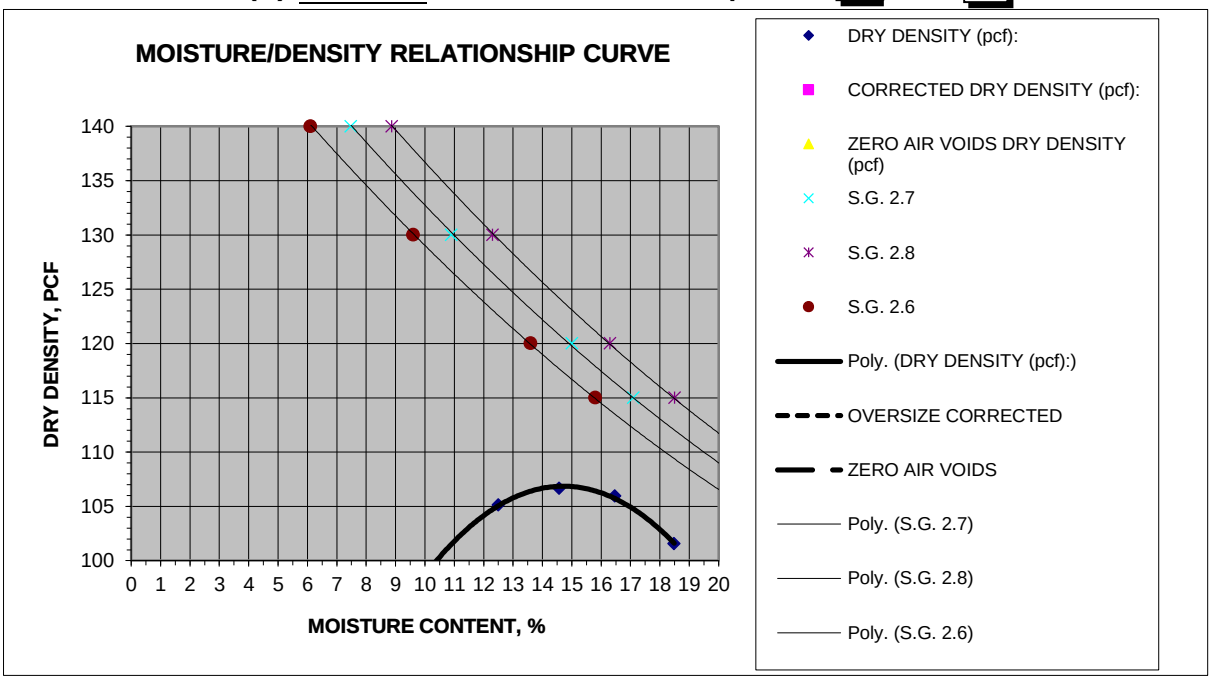
Client: Melia Homes
Project: Cypress Village
Location: Cypress Village
Material Type: Light Brown Fine Sand w/ Silt
Material Supplier:
Material Source:
Sample Location: B-1 @ 1 - 5

Job No.: 1763-CR
Lab No.: Corona

Sampled By: DRW
Received By: DA
Tested By: DA
Reviewed By:

Date Sampled: 0-Jan-00
Date Received:
Date Tested: 26-Sep-17
Date Reviewed:

Test Procedure: ASTM 1557 **Method:** A
Oversized Material (%): 0.0 **Correction Required:** [ ] yes [x] no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	107.0	**@ Optimum Moisture, %**	15.0
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification:
AASHTO Soils Classification:

GEOTEK

MOISTURE/DENSITY RELATIONSHIP

Client: Melia Homes
Project: Seniors Development
Location: Cypress
Material Type: Fine to medium sand with some silt, brown
Material Supplier: -
Material Source: -
Sample Location: B-7 @ 0-5 feet
-

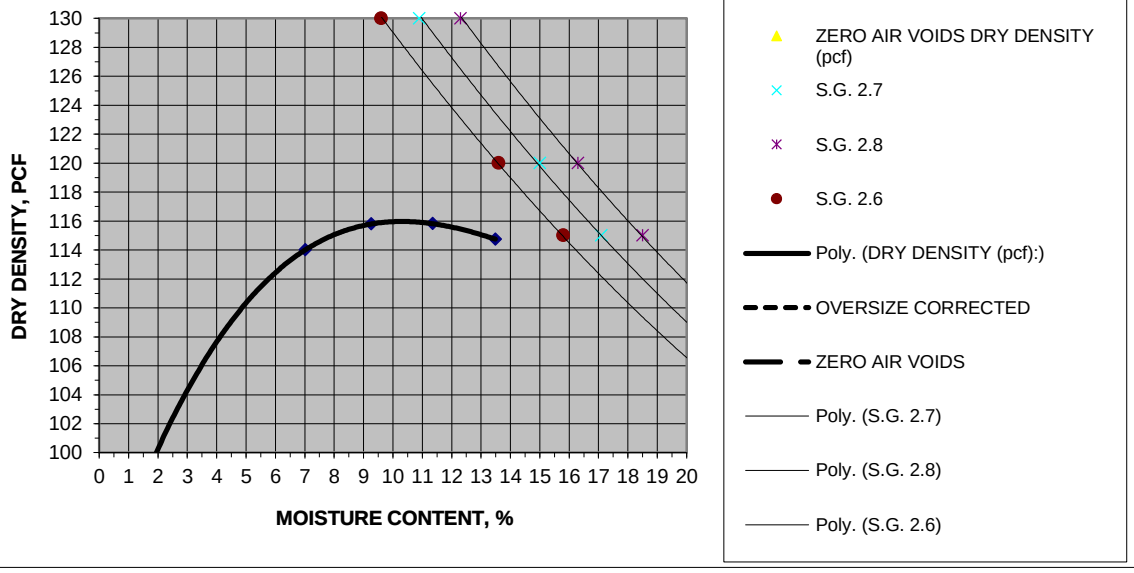
Job No.: 2573-CR
Lab No.: Corona

Sampled By: JE
Received By: DA
Tested By: FS
Reviewed By: DA

Date Sampled: 12/9/2020
Date Received: 12/9/2020
Date Tested: 12/15/2020
Date Reviewed: 12/29/2020

Test Procedure: ASTM D1557 **Method:** A
Oversized Material (%): 0.0 **Correction Required:** [ ] yes [x] no

MOISTURE/DENSITY RELATIONSHIP CURVE



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	116.0	**@ Optimum Moisture, %**	10.5
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification:
AASHTO Soils Classification:

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	Melia Homes	***Tested/ Checked By:***	GP Lab No Corona
Project Number:	2573-CR	***Date Tested:***	12/18/2020
Project Location:	Seniors Developments, Cypress	***Sample Source:***	B-7 @ 0-5 feet
		Sample Description:	

Ring #: _____ Ring Dia. : 4.01" Ring Ht.1"

DENSITY DETERMINATION

A	Weight of compacted sample & ring (gm)	748.2
B	Weight of ring (gm)	362.4
C	Net weight of sample (gm)	**385.8**
D	Wet Density, lb / ft3 (C*0.3016)	**116.4**
E	Dry Density, lb / ft3 (D/1.F)	**104.8**

SATURATION DETERMINATION

F	Moisture Content, %	11.0
G	Specific Gravity, assumed	**2.70**
H	Unit Wt. of Water @ 20 °C, (pcf)	**62.4**
I	% Saturation	**48.9**

READINGS

DATE	TIME	READING	
12/18/2020	7:31	0.5770	Initial
12/18/2020	7:41	0.5760	10 min/Dry
12/19/2020		0.5760	Final

FINAL MOISTURE

Final Weight of wet sample & tare	% Moisture
775.2	**18.0**

EXPANSION INDEX = 0

Soil Analysis Lab Results

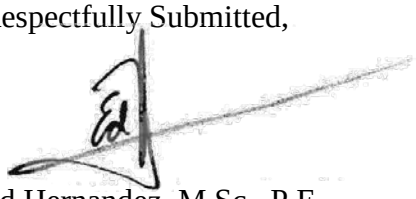
Client: Geotek Inc
Job Name: Cypress
Client Job Number: 1763-CR
Project X Job Number: S170927F
September 30, 2017

	Method	ASTM G187	ASTM G187	ASTM D516		ASTM D512B		SM 4500-E	SM 4500-C	SM 4500-D	ASTM G200	ASTM G51
Bore# / Description	**Depth**	**As-Rec'd Resistivity**	**Min-Resistivity**	**Sulfates**		**Chlorides**		**Nitrate**	**Ammonia**	**Sulfide**	**Redox**	**pH**
	(ft)	(Ohm-cm)	(Ohm-cm)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(mg/kg)	(mg/kg)	(mg/kg)	(mV)	
#1	1.0-5.0	8,710	5,226	3	0.0003	126	0.0126	27	26.6	1.65	206	9.35

Unk = Unknown
ND = 0 = Not Detected
NT = Not Tested
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
Chemical Analysis performed on 1:3 Soil-To-Water extract

Please call if you have any questions.

Respectfully Submitted,



Ed Hernandez, M.Sc., P.E.
Sr. Corrosion Consultant
NACE Corrosion Technologist #16592
Professional Engineer
California No. M37102
ehernandez@projectxcorrosion.com

Soil Analysis Lab Results

Client: GeoTek, Inc.
Job Name: Orange-Ave
Client Job Number: 2573-CR
Project X Job Number: S201216A
December 17, 2020

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM D4972	ASTM G200	SM 4500-S2-D	ASTM D4327	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D4327	ASTM D4327
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity** As Rec'd | Minimum		**pH**	**Redox**	**Sulfide** S^{2-}	**Nitrate** NO_3^-	**Ammonium** NH_4^+	**Lithium** Li^+	**Sodium** Na^+	**Potassium** K^+	**Magnesium** Mg^{2+}	**Calcium** Ca^{2+}	**Fluoride** F_2^-	**Phosphate** PO_4^{3-}
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ohm-cm)	(Ohm-cm)		(mV)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
B-7	0-5	54.4	0.0054	20.4	0.0020	16,080	8,040	9.4	199	<0.01	0.6	38.6	ND	46.6	141.4	44.2	326.9	3.2	11.6

Cations and Anions, except Sulfide and Bicarbonate, tested with Ion Chromatography
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract

APPENDIX D

LIQUEFACTION AND SETTLEMENT ANALYSES

Updated Geotechnical Evaluation
Orange Avenue Seniors, Cypress, California
Project No. 2573-CR

GEOTEK

GeoTek, Inc.
1548 N. Maple Street
Corona, CA 92880
http://www.geotekusa.com

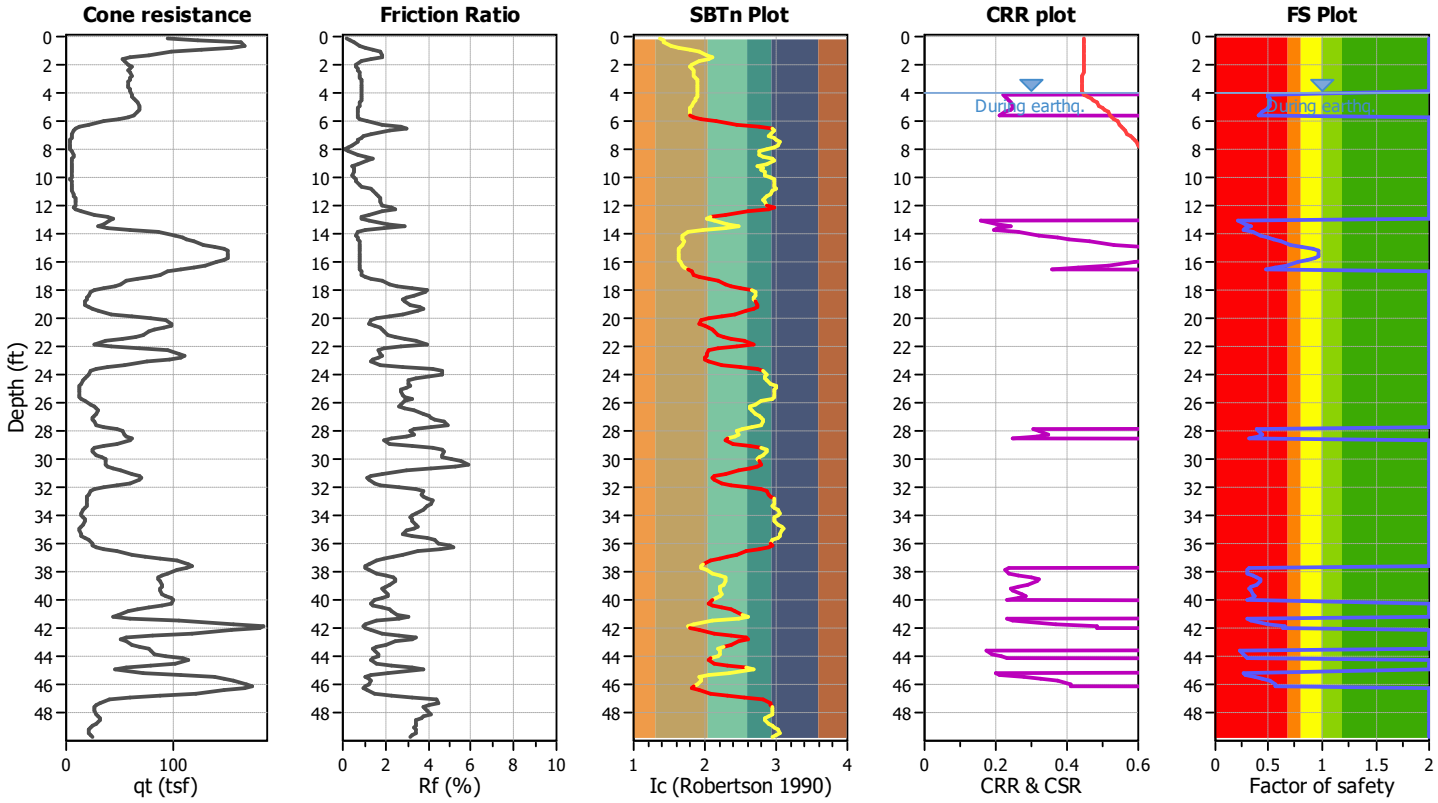
LIQUEFACTION ANALYSIS REPORT

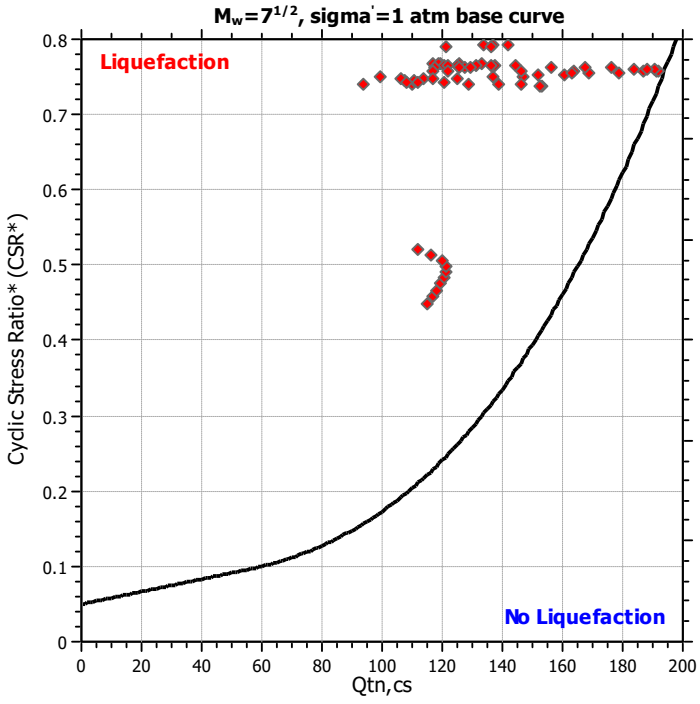
Project title : Orange Avenue Seniors **Location : Cypress, CA**

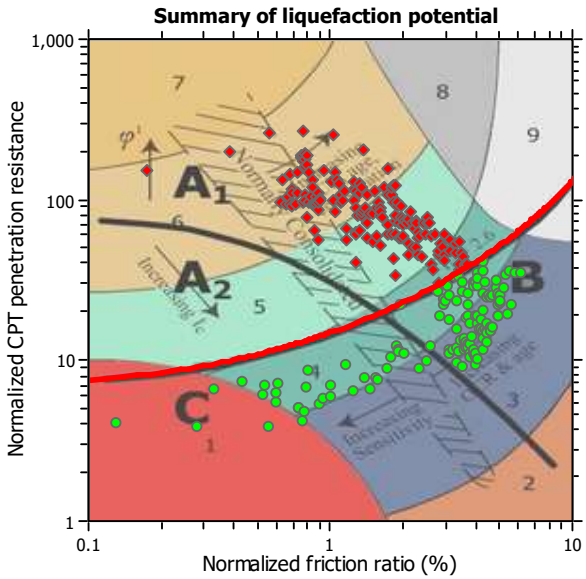
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	4.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.72	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.70	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

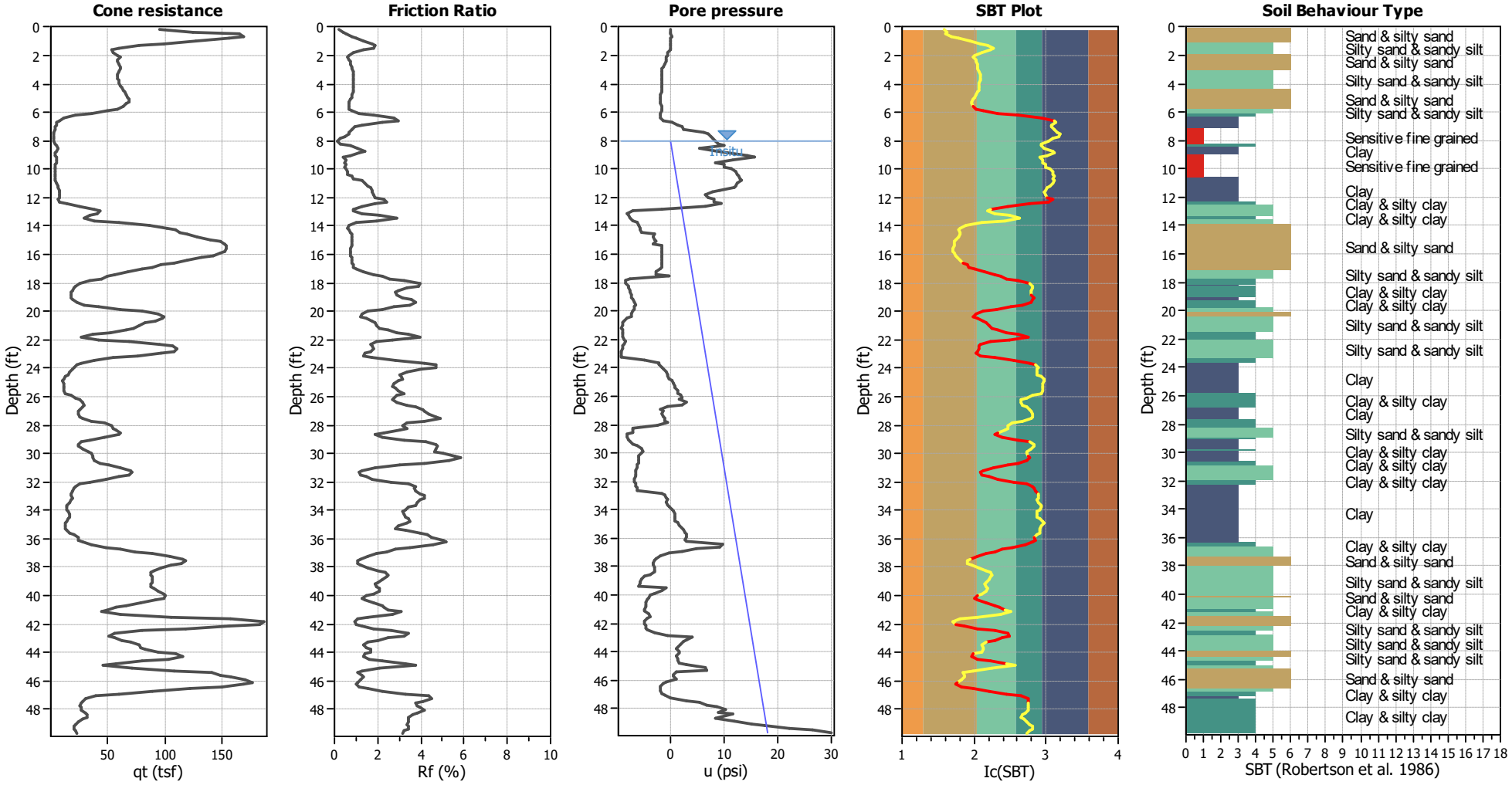






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



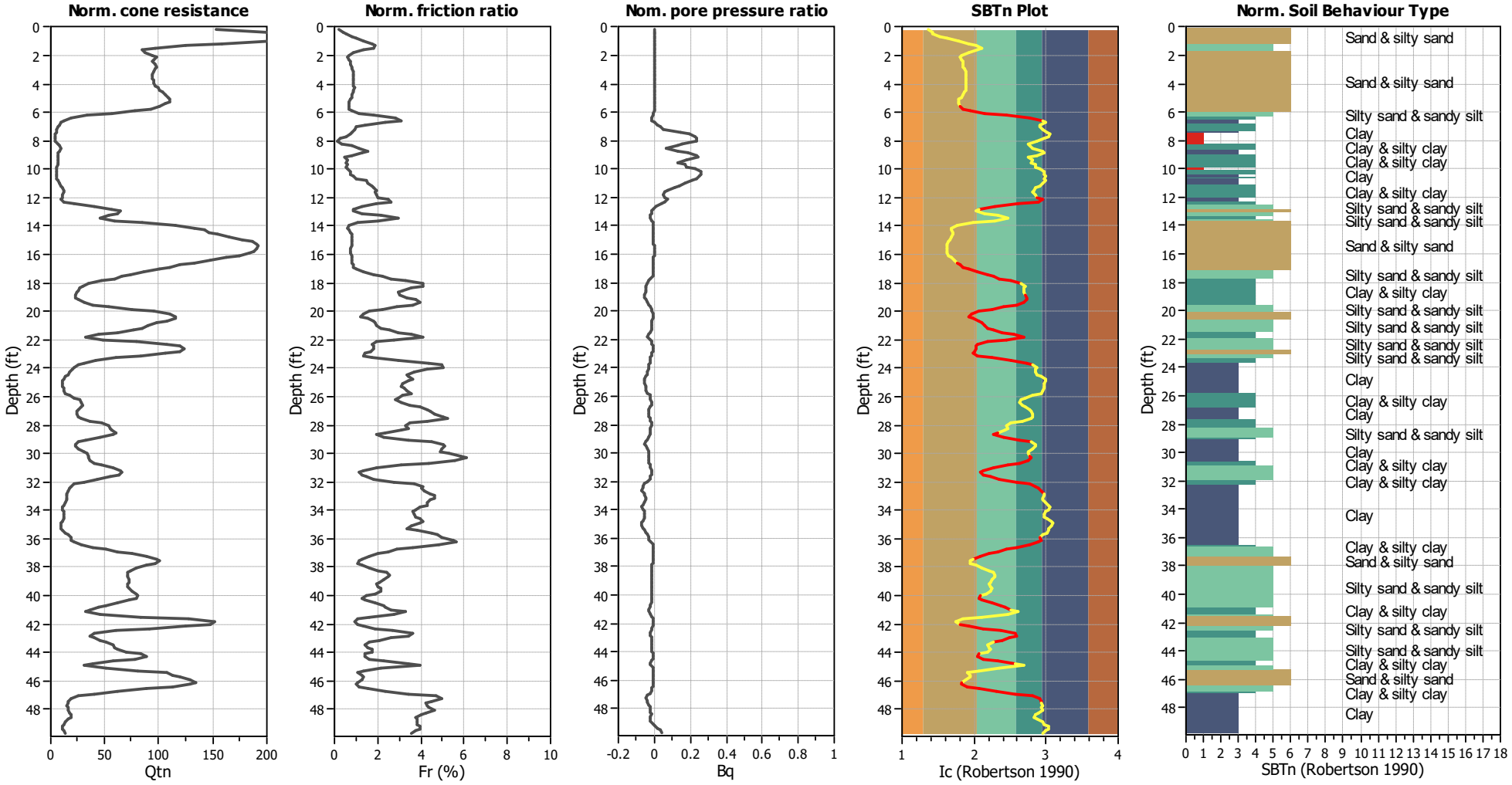
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	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:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.70	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



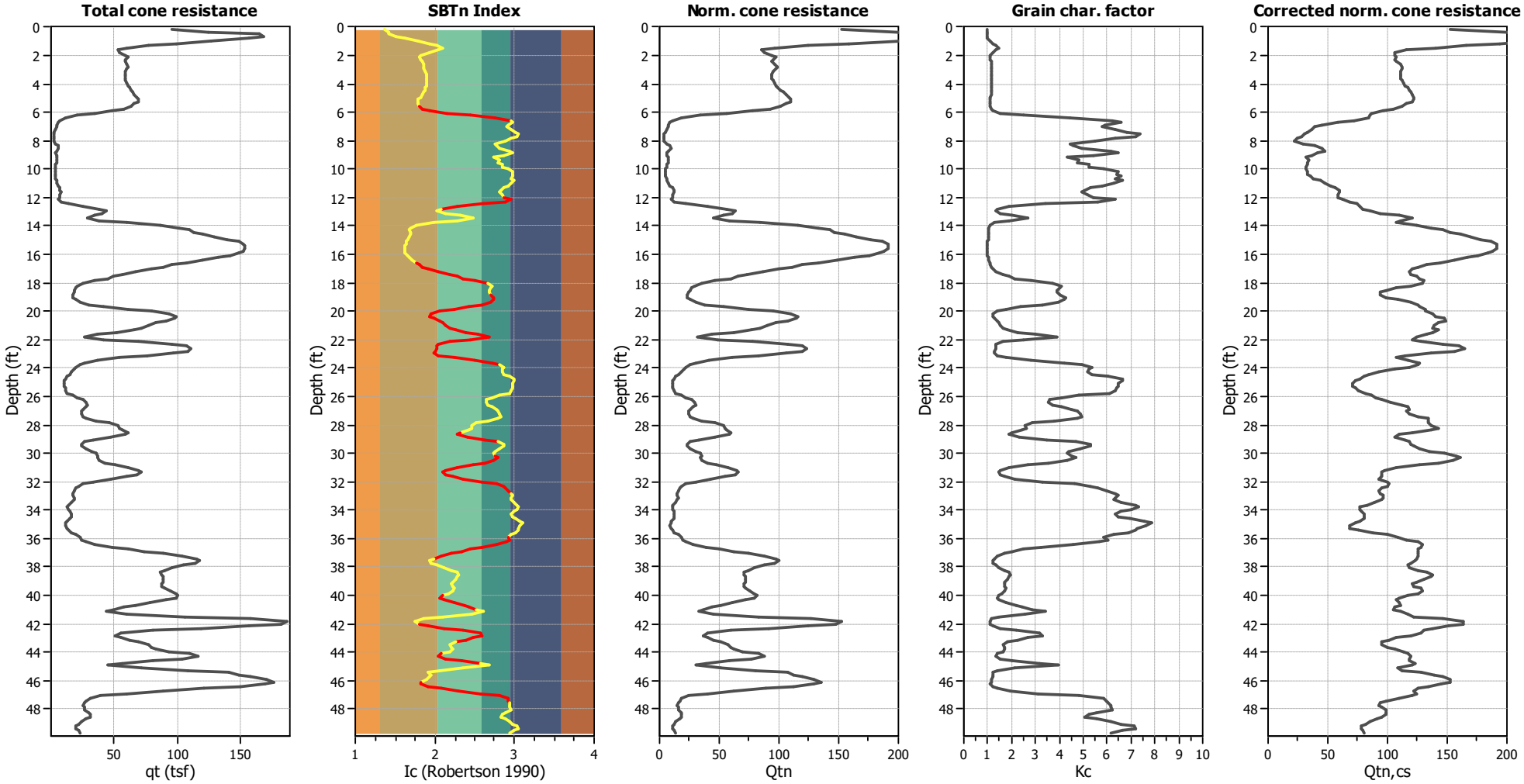
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	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:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.70	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

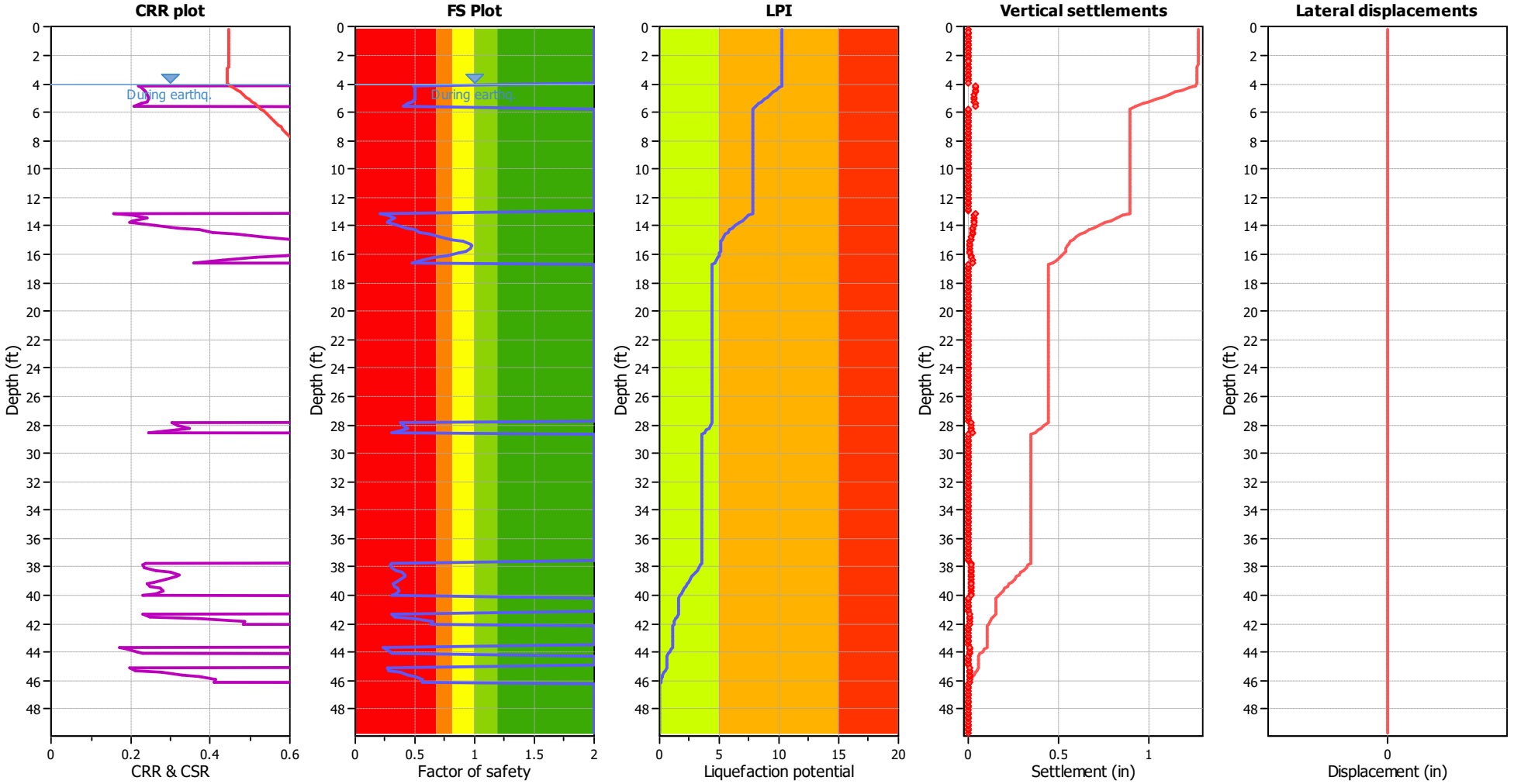
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	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:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.70	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	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:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.70	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

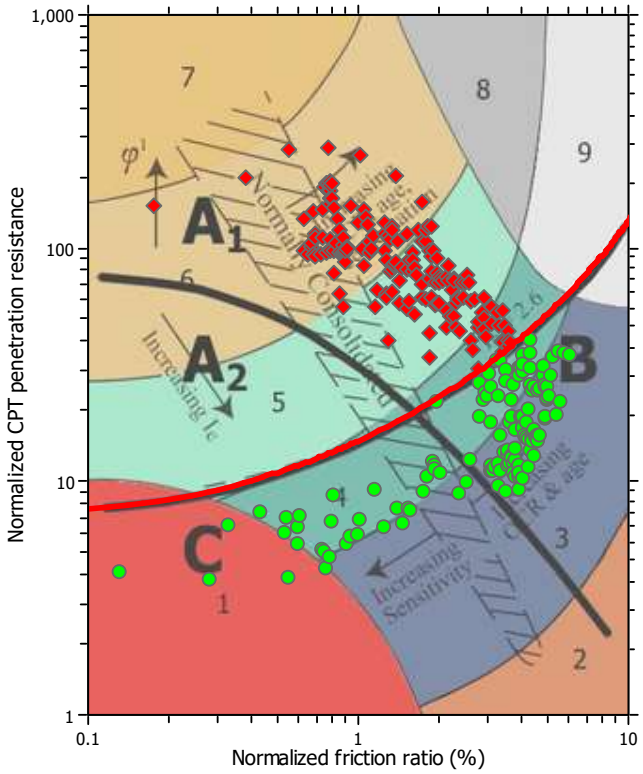
F.S. color scheme

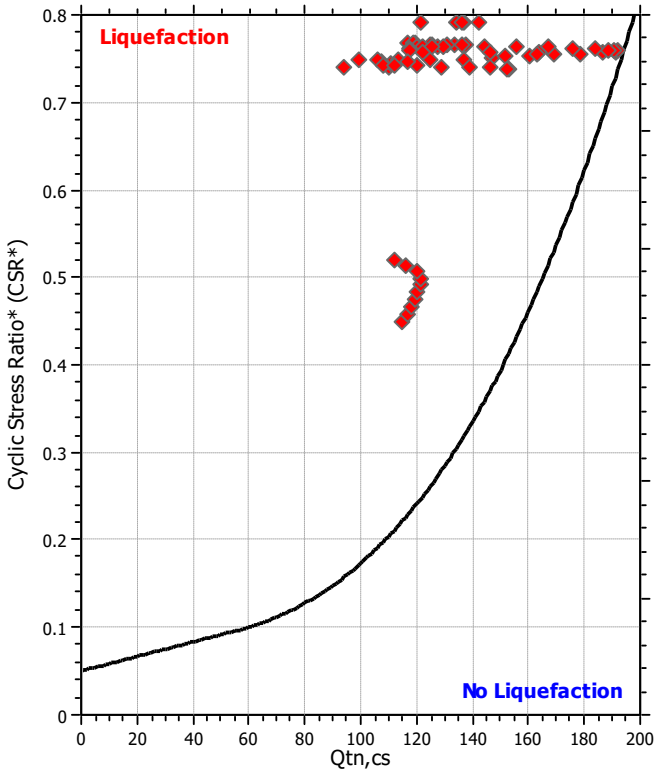
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

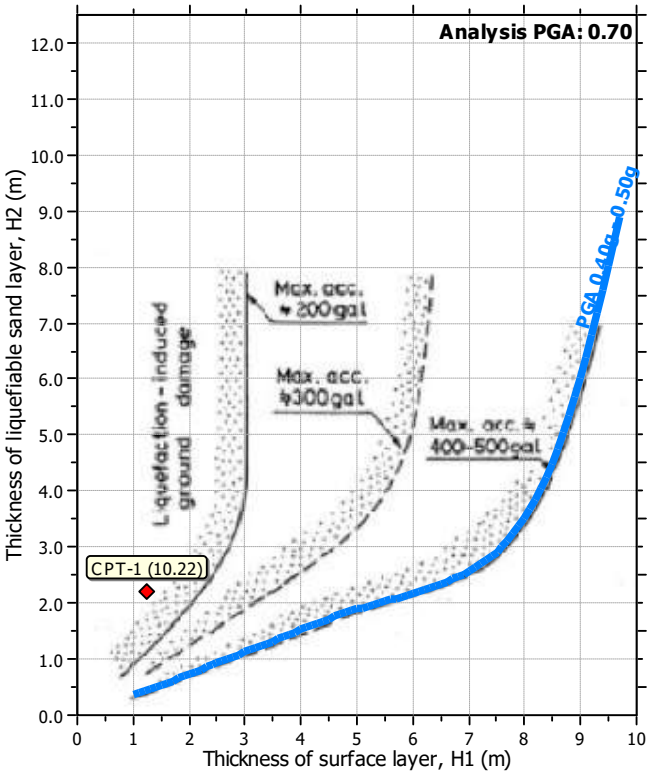
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



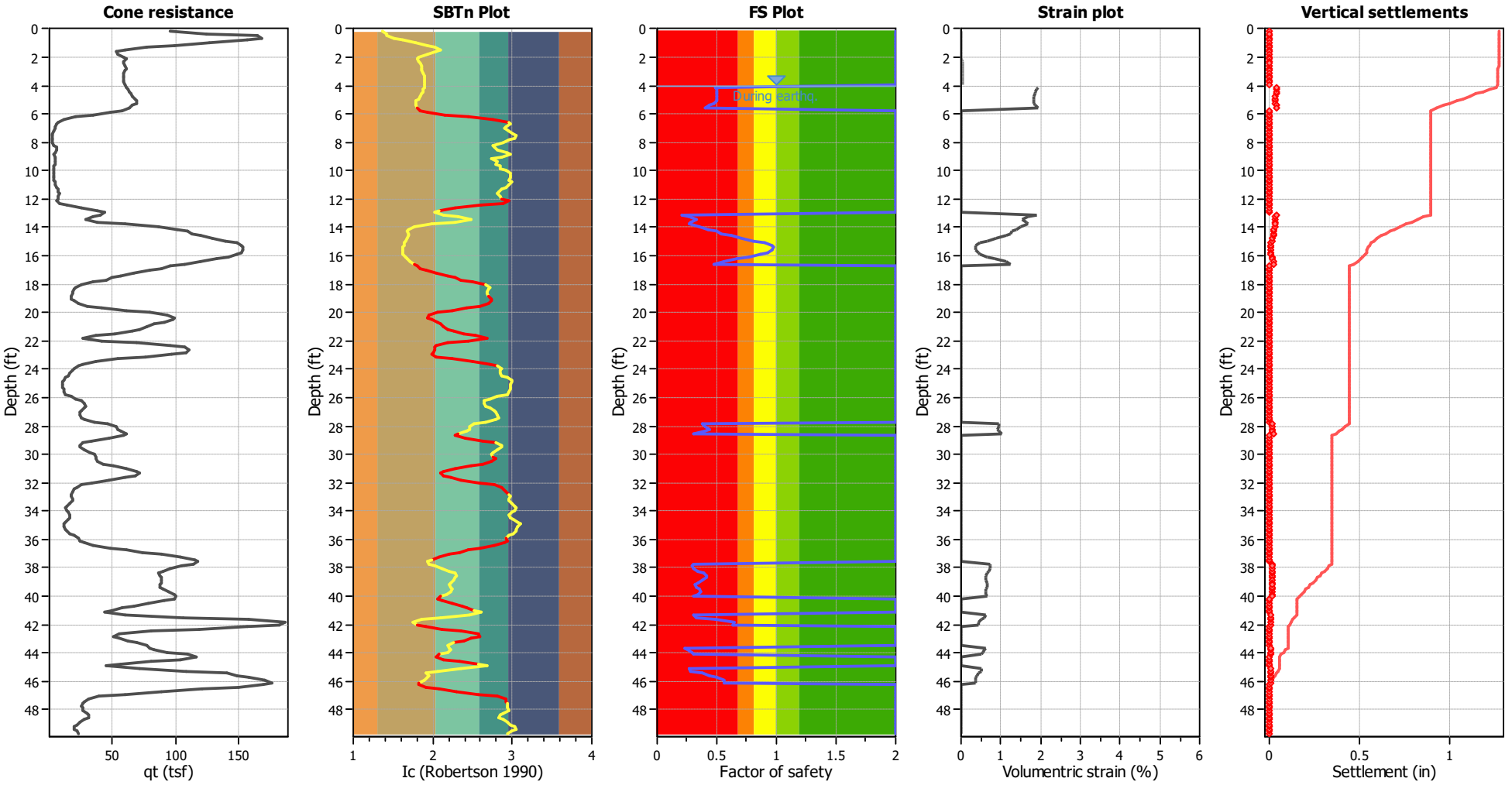




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	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:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.70	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.16	1.37	152.94	1.00	152.94	26	483	0.45	0.001	0.00	8.77	0.00	0.000
0.33	1.42	199.84	1.00	199.84	34	676	0.45	0.001	0.00	8.77	0.00	0.000
0.49	1.42	263.87	1.00	263.87	45	897	0.45	0.002	0.00	8.77	0.00	0.000
0.66	1.52	270.12	1.00	270.12	47	1035	0.45	0.002	0.00	8.77	0.00	0.000
0.82	1.63	251.09	1.00	251.09	46	1108	0.45	0.002	0.00	8.77	0.00	0.000
0.98	1.79	203.79	1.10	223.47	43	1096	0.45	0.003	0.00	8.77	0.00	0.000
1.15	1.93	158.52	1.22	193.41	39	1025	0.45	0.004	0.00	8.77	0.00	0.000
1.31	2.03	124.49	1.34	166.26	35	907	0.45	0.005	0.00	8.77	0.00	0.000
1.48	2.10	96.74	1.45	140.27	30	772	0.45	0.007	0.00	8.77	0.00	0.000
1.64	2.05	84.88	1.37	116.26	25	637	0.45	0.012	0.01	8.77	0.01	0.000
1.80	1.93	87.43	1.21	106.14	21	561	0.45	0.017	0.02	8.77	0.01	0.000
1.97	1.82	94.21	1.12	105.61	21	528	0.45	0.022	0.02	8.77	0.02	0.001
2.13	1.80	97.46	1.10	107.62	21	531	0.45	0.024	0.02	8.77	0.02	0.001
2.30	1.83	94.66	1.13	106.67	21	536	0.45	0.027	0.03	8.77	0.02	0.001
2.46	1.84	94.27	1.14	107.47	21	545	0.45	0.029	0.03	8.77	0.02	0.001
2.62	1.85	96.44	1.15	110.53	22	563	0.44	0.029	0.03	8.77	0.02	0.001
2.79	1.85	98.19	1.15	112.70	22	575	0.44	0.030	0.03	8.77	0.02	0.001
2.95	1.87	97.15	1.16	112.47	22	577	0.44	0.033	0.03	8.77	0.02	0.001
3.12	1.88	95.00	1.17	111.39	22	577	0.44	0.036	0.03	8.77	0.02	0.001
3.28	1.89	93.64	1.18	110.70	22	576	0.44	0.039	0.03	8.77	0.03	0.001
3.44	1.89	93.63	1.18	110.84	22	578	0.44	0.042	0.04	8.77	0.03	0.001
3.61	1.89	94.20	1.18	111.50	22	581	0.44	0.045	0.04	8.77	0.03	0.001
3.77	1.89	94.93	1.18	112.25	22	585	0.44	0.048	0.04	8.77	0.03	0.001
3.94	1.89	95.83	1.18	113.26	23	590	0.44	0.050	0.04	8.77	0.03	0.001

Total estimated settlement: 0.01

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
4.10	114.70	0.49	1.94	0.93	0.04	4.27	116.62	0.50	1.91	0.93	0.04
4.43	118.35	0.50	1.88	0.92	0.04	4.59	119.46	0.50	1.86	0.92	0.04
4.76	120.45	0.50	1.84	0.92	0.04	4.92	121.48	0.50	1.83	0.92	0.04
5.09	121.47	0.49	1.82	0.91	0.04	5.25	120.27	0.48	1.83	0.91	0.04
5.41	116.10	0.44	1.88	0.91	0.04	5.58	111.90	0.40	1.93	0.91	0.04
5.74	105.06	2.00	0.00	0.90	0.00	5.91	96.09	2.00	0.00	0.90	0.00
6.07	86.69	2.00	0.00	0.90	0.00	6.23	84.78	2.00	0.00	0.89	0.00
6.40	83.62	2.00	0.00	0.89	0.00	6.56	72.17	2.00	0.00	0.89	0.00
6.73	58.11	2.00	0.00	0.89	0.00	6.89	45.50	2.00	0.00	0.88	0.00
7.05	39.44	2.00	0.00	0.88	0.00	7.22	36.26	2.00	0.00	0.88	0.00
7.38	32.48	2.00	0.00	0.87	0.00	7.55	30.89	2.00	0.00	0.87	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
7.71	27.82	2.00	0.00	0.87	0.00	7.87	24.26	2.00	0.00	0.87	0.00
8.04	22.43	2.00	0.00	0.86	0.00	8.20	28.83	2.00	0.00	0.86	0.00
8.37	39.36	2.00	0.00	0.86	0.00	8.53	45.35	2.00	0.00	0.86	0.00
8.69	47.03	2.00	0.00	0.85	0.00	8.86	41.22	2.00	0.00	0.85	0.00
9.02	36.40	2.00	0.00	0.85	0.00	9.19	31.71	2.00	0.00	0.84	0.00
9.35	34.17	2.00	0.00	0.84	0.00	9.51	32.96	2.00	0.00	0.84	0.00
9.68	32.91	2.00	0.00	0.84	0.00	9.84	31.59	2.00	0.00	0.83	0.00
10.01	31.44	2.00	0.00	0.83	0.00	10.17	32.60	2.00	0.00	0.83	0.00
10.33	32.63	2.00	0.00	0.82	0.00	10.50	35.06	2.00	0.00	0.82	0.00
10.66	37.33	2.00	0.00	0.82	0.00	10.83	43.80	2.00	0.00	0.82	0.00
10.99	47.02	2.00	0.00	0.81	0.00	11.15	51.93	2.00	0.00	0.81	0.00
11.32	55.55	2.00	0.00	0.81	0.00	11.48	59.43	2.00	0.00	0.81	0.00
11.65	59.86	2.00	0.00	0.80	0.00	11.81	58.94	2.00	0.00	0.80	0.00
11.98	59.05	2.00	0.00	0.80	0.00	12.14	61.98	2.00	0.00	0.79	0.00
12.30	68.76	2.00	0.00	0.79	0.00	12.47	74.01	2.00	0.00	0.79	0.00
12.63	77.33	2.00	0.00	0.79	0.00	12.80	79.87	2.00	0.00	0.78	0.00
12.96	85.34	2.00	0.00	0.78	0.00	13.12	93.94	0.21	1.91	0.78	0.04
13.29	109.82	0.27	1.68	0.77	0.03	13.45	120.32	0.33	1.55	0.77	0.03
13.62	110.84	0.28	1.65	0.77	0.03	13.78	107.64	0.26	1.69	0.77	0.03
13.94	124.96	0.35	1.49	0.76	0.03	14.11	137.06	0.43	1.37	0.76	0.03
14.27	146.76	0.50	1.29	0.76	0.03	14.44	151.97	0.54	1.25	0.76	0.02
14.60	160.48	0.62	1.15	0.75	0.02	14.76	169.05	0.70	0.87	0.75	0.02
14.93	178.66	0.81	0.65	0.75	0.01	15.09	186.77	0.91	0.46	0.74	0.01
15.26	191.02	0.96	0.36	0.74	0.01	15.42	191.84	0.97	0.36	0.74	0.01
15.58	190.91	0.96	0.36	0.74	0.01	15.75	188.40	0.92	0.45	0.73	0.01
15.91	183.85	0.86	0.46	0.73	0.01	16.08	176.04	0.77	0.65	0.73	0.01
16.24	167.20	0.67	0.86	0.72	0.02	16.40	156.00	0.57	1.15	0.72	0.02
16.57	144.25	0.47	1.24	0.72	0.02	16.73	132.73	2.00	0.00	0.72	0.00
16.90	126.09	2.00	0.00	0.71	0.00	17.06	120.81	2.00	0.00	0.71	0.00
17.22	117.70	2.00	0.00	0.71	0.00	17.39	120.01	2.00	0.00	0.71	0.00
17.55	123.85	2.00	0.00	0.70	0.00	17.72	127.36	2.00	0.00	0.70	0.00
17.88	130.03	2.00	0.00	0.70	0.00	18.04	129.42	2.00	0.00	0.69	0.00
18.21	119.55	2.00	0.00	0.69	0.00	18.37	107.01	2.00	0.00	0.69	0.00
18.54	98.22	2.00	0.00	0.69	0.00	18.70	94.24	2.00	0.00	0.68	0.00
18.86	93.67	2.00	0.00	0.68	0.00	19.03	98.40	2.00	0.00	0.68	0.00
19.19	109.12	2.00	0.00	0.67	0.00	19.36	119.31	2.00	0.00	0.67	0.00
19.52	125.58	2.00	0.00	0.67	0.00	19.69	127.03	2.00	0.00	0.67	0.00
19.85	132.11	2.00	0.00	0.66	0.00	20.01	131.99	2.00	0.00	0.66	0.00
20.18	137.27	2.00	0.00	0.66	0.00	20.34	140.41	2.00	0.00	0.66	0.00
20.51	147.46	2.00	0.00	0.65	0.00	20.67	148.20	2.00	0.00	0.65	0.00
20.83	142.89	2.00	0.00	0.65	0.00	21.00	138.53	2.00	0.00	0.64	0.00
21.16	138.12	2.00	0.00	0.64	0.00	21.33	142.56	2.00	0.00	0.64	0.00
21.49	137.95	2.00	0.00	0.64	0.00	21.65	132.32	2.00	0.00	0.63	0.00
21.82	124.56	2.00	0.00	0.63	0.00	21.98	120.24	2.00	0.00	0.63	0.00
22.15	127.80	2.00	0.00	0.62	0.00	22.31	146.86	2.00	0.00	0.62	0.00
22.47	159.63	2.00	0.00	0.62	0.00	22.64	164.28	2.00	0.00	0.62	0.00
22.80	155.93	2.00	0.00	0.61	0.00	22.97	136.77	2.00	0.00	0.61	0.00
23.13	114.67	2.00	0.00	0.61	0.00	23.29	106.80	2.00	0.00	0.61	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
23.46	116.94	2.00	0.00	0.60	0.00	23.62	126.50	2.00	0.00	0.60	0.00
23.79	125.28	2.00	0.00	0.60	0.00	23.95	118.20	2.00	0.00	0.59	0.00
24.11	105.67	2.00	0.00	0.59	0.00	24.28	93.20	2.00	0.00	0.59	0.00
24.44	84.35	2.00	0.00	0.59	0.00	24.61	80.04	2.00	0.00	0.58	0.00
24.77	77.15	2.00	0.00	0.58	0.00	24.93	73.63	2.00	0.00	0.58	0.00
25.10	71.25	2.00	0.00	0.57	0.00	25.26	70.80	2.00	0.00	0.57	0.00
25.43	73.22	2.00	0.00	0.57	0.00	25.59	75.22	2.00	0.00	0.57	0.00
25.75	81.85	2.00	0.00	0.56	0.00	25.92	86.28	2.00	0.00	0.56	0.00
26.08	90.57	2.00	0.00	0.56	0.00	26.25	95.25	2.00	0.00	0.56	0.00
26.41	102.93	2.00	0.00	0.55	0.00	26.57	112.22	2.00	0.00	0.55	0.00
26.74	116.82	2.00	0.00	0.55	0.00	26.90	117.69	2.00	0.00	0.54	0.00
27.07	116.38	2.00	0.00	0.54	0.00	27.23	118.87	2.00	0.00	0.54	0.00
27.40	126.11	2.00	0.00	0.54	0.00	27.56	134.49	2.00	0.00	0.53	0.00
27.72	134.55	2.00	0.00	0.53	0.00	27.89	134.04	0.38	0.97	0.53	0.02
28.05	136.88	0.40	0.95	0.52	0.02	28.22	142.12	0.44	0.91	0.52	0.02
28.38	136.10	0.40	0.94	0.52	0.02	28.54	121.19	0.31	1.03	0.52	0.02
28.71	109.30	2.00	0.00	0.51	0.00	28.87	106.43	2.00	0.00	0.51	0.00
29.04	114.12	2.00	0.00	0.51	0.00	29.20	118.89	2.00	0.00	0.51	0.00
29.36	119.97	2.00	0.00	0.50	0.00	29.53	121.54	2.00	0.00	0.50	0.00
29.69	126.32	2.00	0.00	0.50	0.00	29.86	135.42	2.00	0.00	0.49	0.00
30.02	147.66	2.00	0.00	0.49	0.00	30.18	157.55	2.00	0.00	0.49	0.00
30.35	160.93	2.00	0.00	0.49	0.00	30.51	154.96	2.00	0.00	0.48	0.00
30.68	142.10	2.00	0.00	0.48	0.00	30.84	126.63	2.00	0.00	0.48	0.00
31.00	107.63	2.00	0.00	0.47	0.00	31.17	98.14	2.00	0.00	0.47	0.00
31.33	95.13	2.00	0.00	0.47	0.00	31.50	95.64	2.00	0.00	0.47	0.00
31.66	95.14	2.00	0.00	0.46	0.00	31.82	93.10	2.00	0.00	0.46	0.00
31.99	99.39	2.00	0.00	0.46	0.00	32.15	101.82	2.00	0.00	0.46	0.00
32.32	99.83	2.00	0.00	0.45	0.00	32.48	95.07	2.00	0.00	0.45	0.00
32.64	93.18	2.00	0.00	0.45	0.00	32.81	93.78	2.00	0.00	0.44	0.00
32.97	96.14	2.00	0.00	0.44	0.00	33.14	96.68	2.00	0.00	0.44	0.00
33.30	94.59	2.00	0.00	0.44	0.00	33.46	89.02	2.00	0.00	0.43	0.00
33.63	82.79	2.00	0.00	0.43	0.00	33.79	76.99	2.00	0.00	0.43	0.00
33.96	76.45	2.00	0.00	0.42	0.00	34.12	77.95	2.00	0.00	0.42	0.00
34.28	80.92	2.00	0.00	0.42	0.00	34.45	80.81	2.00	0.00	0.42	0.00
34.61	80.29	2.00	0.00	0.41	0.00	34.78	76.93	2.00	0.00	0.41	0.00
34.94	72.69	2.00	0.00	0.41	0.00	35.10	68.68	2.00	0.00	0.41	0.00
35.27	68.43	2.00	0.00	0.40	0.00	35.43	75.41	2.00	0.00	0.40	0.00
35.60	88.24	2.00	0.00	0.40	0.00	35.76	99.52	2.00	0.00	0.39	0.00
35.93	108.86	2.00	0.00	0.39	0.00	36.09	116.40	2.00	0.00	0.39	0.00
36.25	125.07	2.00	0.00	0.39	0.00	36.42	129.60	2.00	0.00	0.38	0.00
36.58	127.65	2.00	0.00	0.38	0.00	36.75	125.07	2.00	0.00	0.38	0.00
36.91	125.98	2.00	0.00	0.37	0.00	37.07	125.72	2.00	0.00	0.37	0.00
37.24	126.20	2.00	0.00	0.37	0.00	37.40	124.96	2.00	0.00	0.37	0.00
37.57	123.13	2.00	0.00	0.36	0.00	37.73	119.20	0.31	0.73	0.36	0.01
37.89	116.97	0.30	0.74	0.36	0.01	38.06	118.68	0.31	0.72	0.35	0.01
38.22	125.75	0.35	0.68	0.35	0.01	38.39	133.40	0.39	0.64	0.35	0.01
38.55	137.27	0.42	0.62	0.35	0.01	38.71	136.46	0.41	0.62	0.34	0.01
38.88	131.03	0.38	0.64	0.34	0.01	39.04	124.86	0.34	0.66	0.34	0.01

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
39.21	120.46	0.32	0.67	0.34	0.01	39.37	122.01	0.33	0.66	0.33	0.01
39.53	127.61	0.36	0.63	0.33	0.01	39.70	129.44	0.37	0.62	0.33	0.01
39.86	125.52	0.35	0.63	0.32	0.01	40.03	117.37	0.30	0.66	0.32	0.01
40.19	110.25	2.00	0.00	0.32	0.00	40.35	107.36	2.00	0.00	0.32	0.00
40.52	109.69	2.00	0.00	0.31	0.00	40.68	111.11	2.00	0.00	0.31	0.00
40.85	106.05	2.00	0.00	0.31	0.00	41.01	104.52	2.00	0.00	0.30	0.00
41.17	111.54	2.00	0.00	0.30	0.00	41.34	117.13	0.30	0.61	0.30	0.01
41.50	121.96	0.33	0.59	0.30	0.01	41.67	146.07	0.49	0.50	0.29	0.01
41.83	163.48	0.64	0.43	0.29	0.01	41.99	163.16	0.64	0.43	0.29	0.01
42.16	150.92	2.00	0.00	0.29	0.00	42.32	137.28	2.00	0.00	0.28	0.00
42.49	130.67	2.00	0.00	0.28	0.00	42.65	128.08	2.00	0.00	0.28	0.00
42.81	118.96	2.00	0.00	0.27	0.00	42.98	107.52	2.00	0.00	0.27	0.00
43.14	101.61	2.00	0.00	0.27	0.00	43.31	94.70	2.00	0.00	0.27	0.00
43.47	94.93	2.00	0.00	0.26	0.00	43.64	99.55	0.23	0.61	0.26	0.01
43.80	106.13	0.26	0.57	0.26	0.01	43.96	113.59	0.29	0.54	0.25	0.01
44.13	117.06	0.31	0.52	0.25	0.01	44.29	119.95	2.00	0.00	0.25	0.00
44.46	117.74	2.00	0.00	0.25	0.00	44.62	118.62	2.00	0.00	0.24	0.00
44.78	123.49	2.00	0.00	0.24	0.00	44.95	120.94	2.00	0.00	0.24	0.00
45.11	108.38	0.27	0.51	0.24	0.01	45.28	112.10	0.28	0.49	0.23	0.01
45.44	128.55	0.37	0.44	0.23	0.01	45.60	138.79	0.44	0.41	0.23	0.01
45.77	146.55	0.50	0.38	0.22	0.01	45.93	152.88	0.56	0.36	0.22	0.01
46.10	152.39	0.55	0.36	0.22	0.01	46.26	145.70	2.00	0.00	0.22	0.00
46.42	134.73	2.00	0.00	0.21	0.00	46.59	125.31	2.00	0.00	0.21	0.00
46.75	122.49	2.00	0.00	0.21	0.00	46.92	124.28	2.00	0.00	0.20	0.00
47.08	120.46	2.00	0.00	0.20	0.00	47.24	109.56	2.00	0.00	0.20	0.00
47.41	99.32	2.00	0.00	0.20	0.00	47.57	93.36	2.00	0.00	0.19	0.00
47.74	93.09	2.00	0.00	0.19	0.00	47.90	95.31	2.00	0.00	0.19	0.00
48.06	98.24	2.00	0.00	0.19	0.00	48.23	98.87	2.00	0.00	0.18	0.00
48.39	99.00	2.00	0.00	0.18	0.00	48.56	95.64	2.00	0.00	0.18	0.00
48.72	91.90	2.00	0.00	0.17	0.00	48.88	85.50	2.00	0.00	0.17	0.00
49.05	81.35	2.00	0.00	0.17	0.00	49.21	78.38	2.00	0.00	0.17	0.00
49.38	78.12	2.00	0.00	0.16	0.00	49.54	79.33	2.00	0.00	0.16	0.00
49.70	80.59	2.00	0.00	0.16	0.00						

Total estimated settlement: 1.26

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

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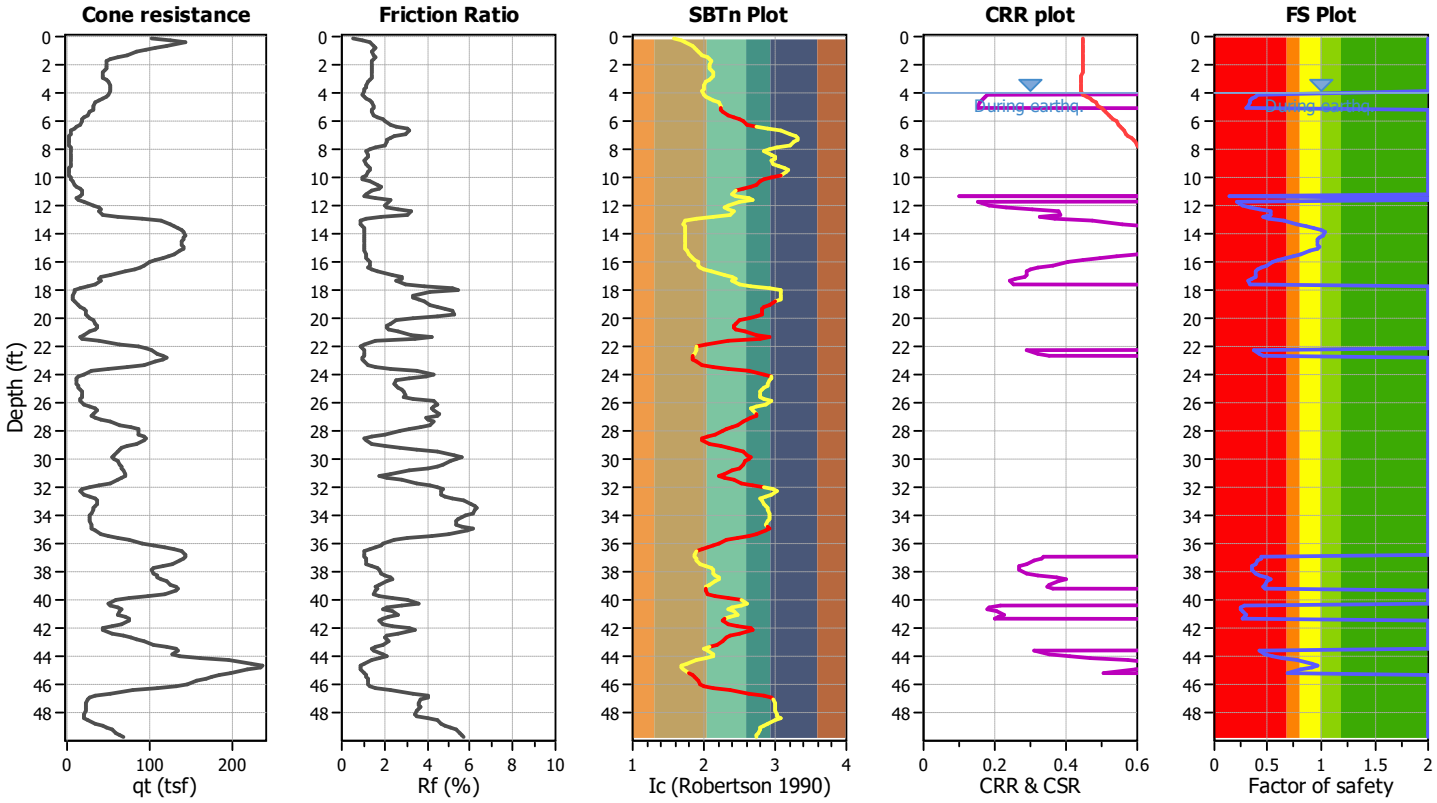
LIQUEFACTION ANALYSIS REPORT

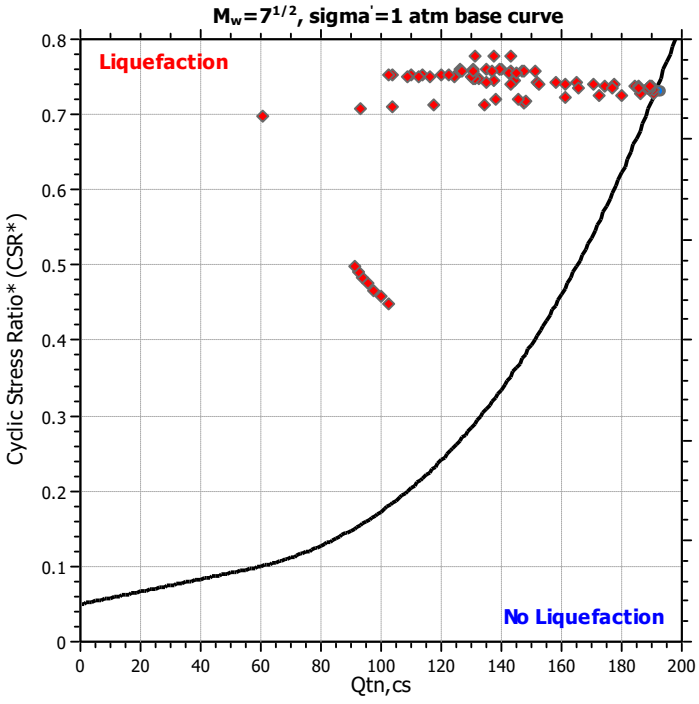
Project title : Orange Avenue Seniors **Location : Cypress, CA**

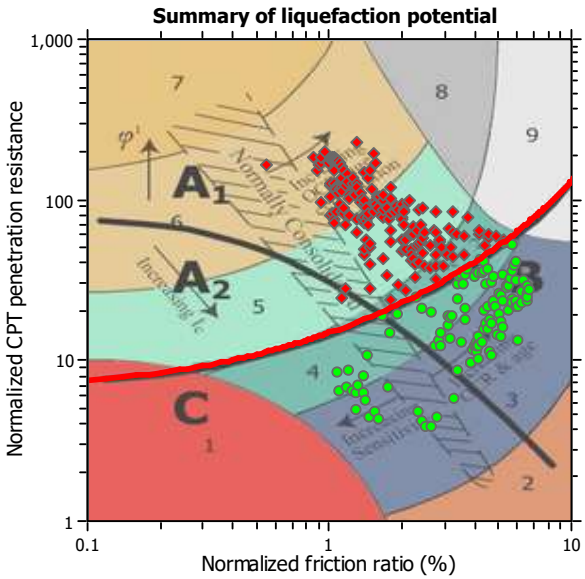
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	4.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	60.00 ft
Earthquake magnitude M_w:	6.72	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.70	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

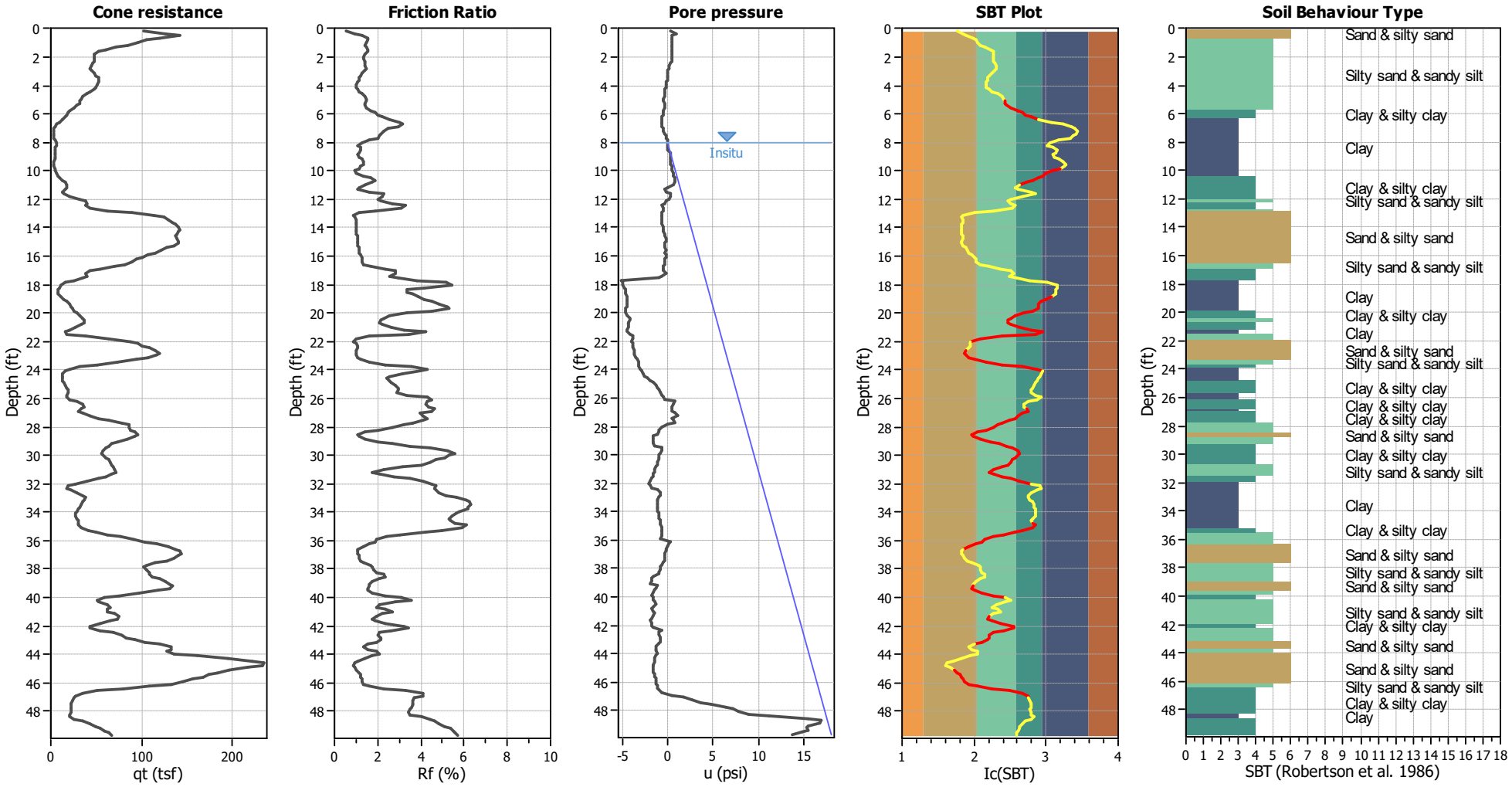






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



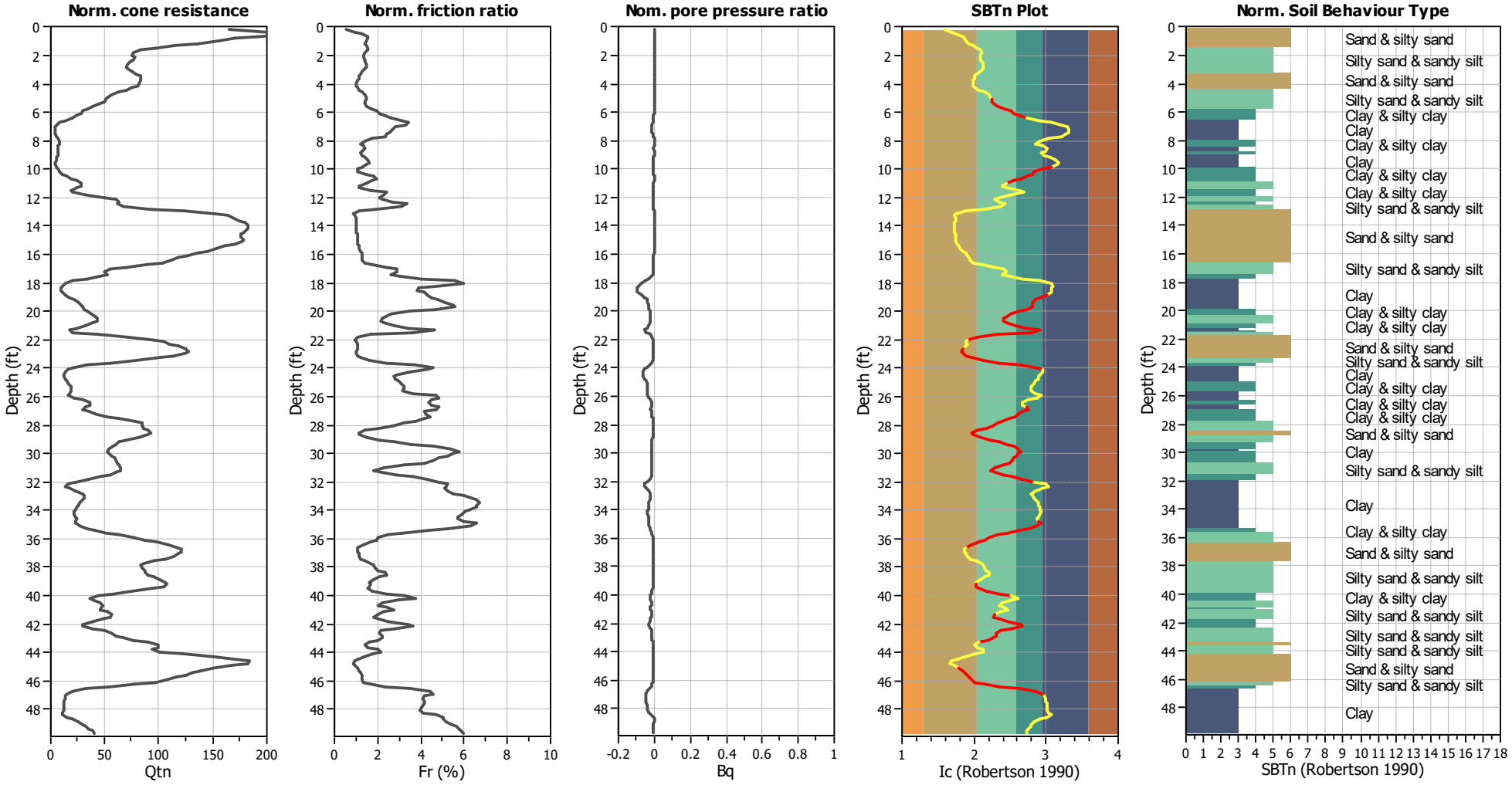
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	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:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.70	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



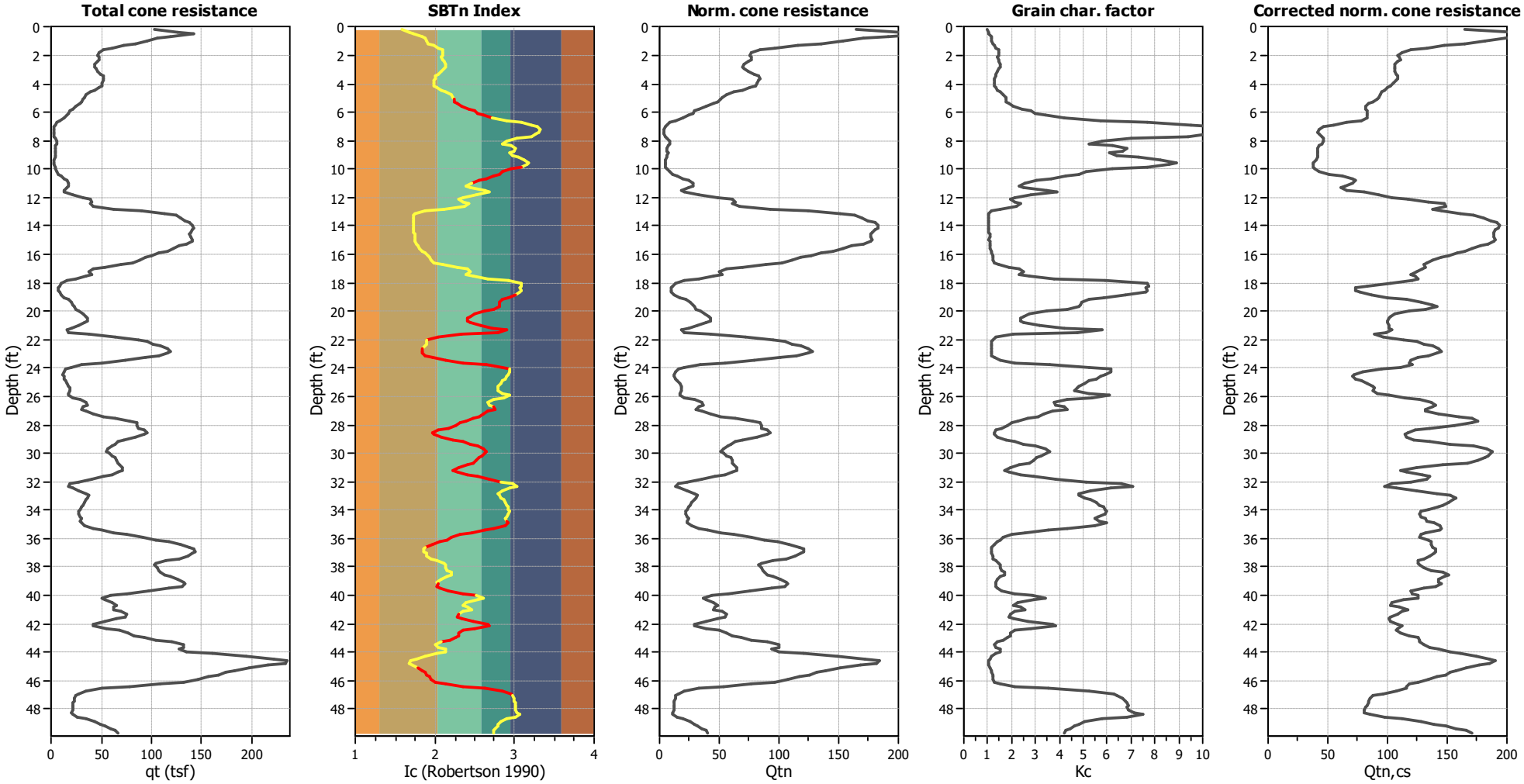
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	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:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.70	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

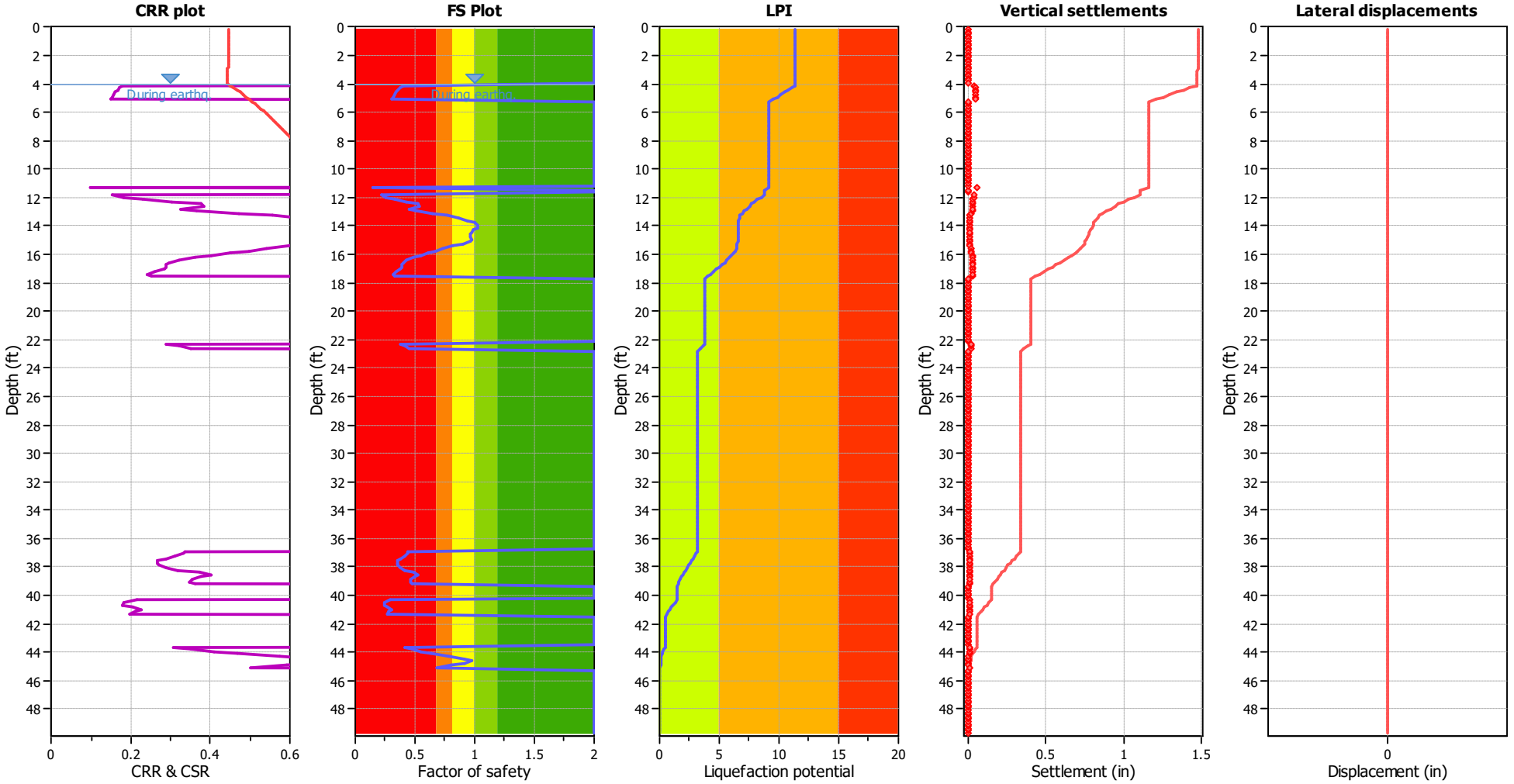
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	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:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.70	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	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:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.70	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

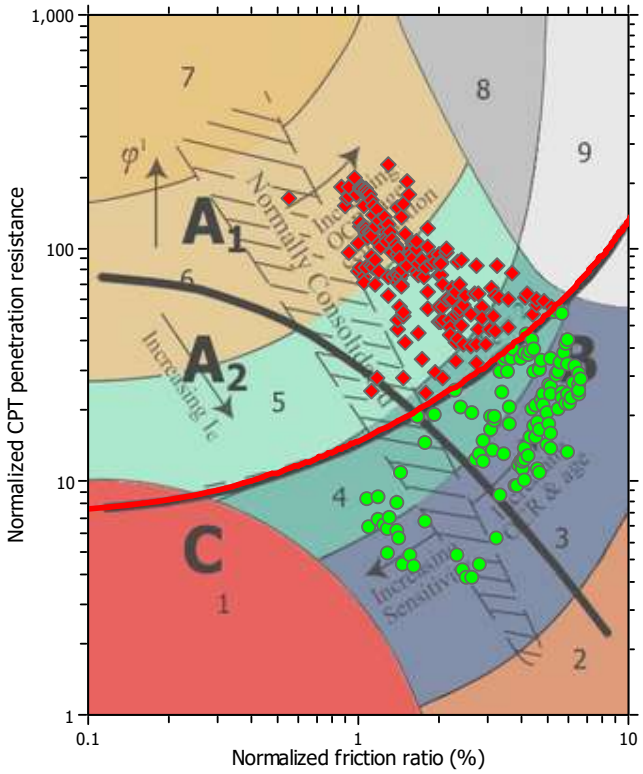
F.S. color scheme

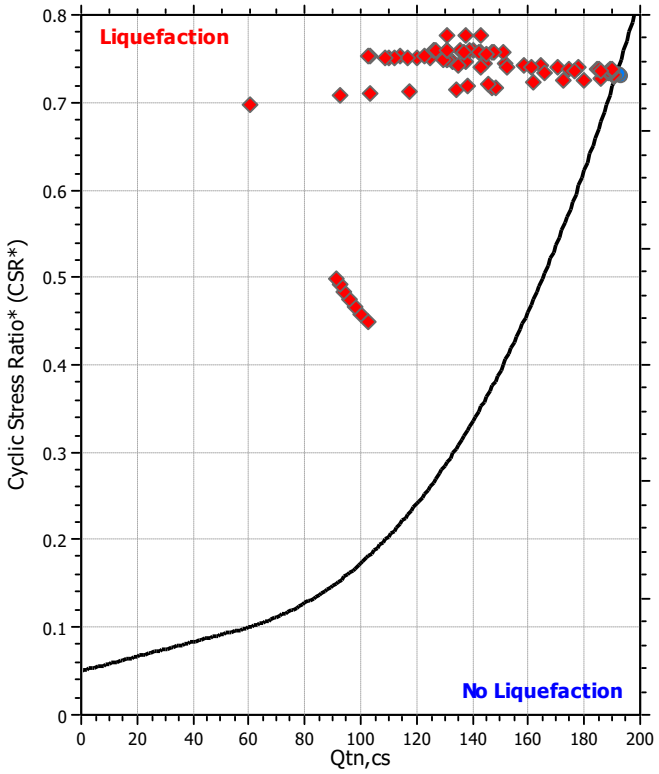
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

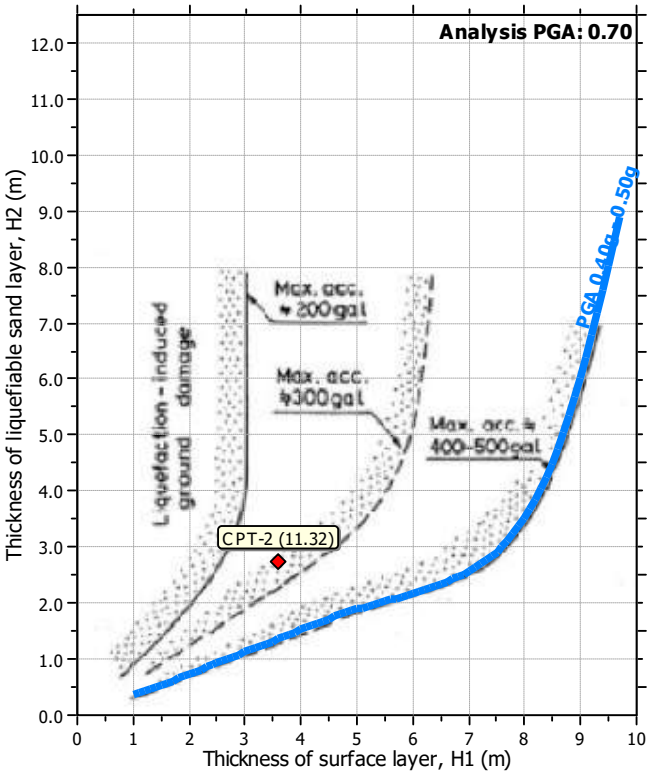
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



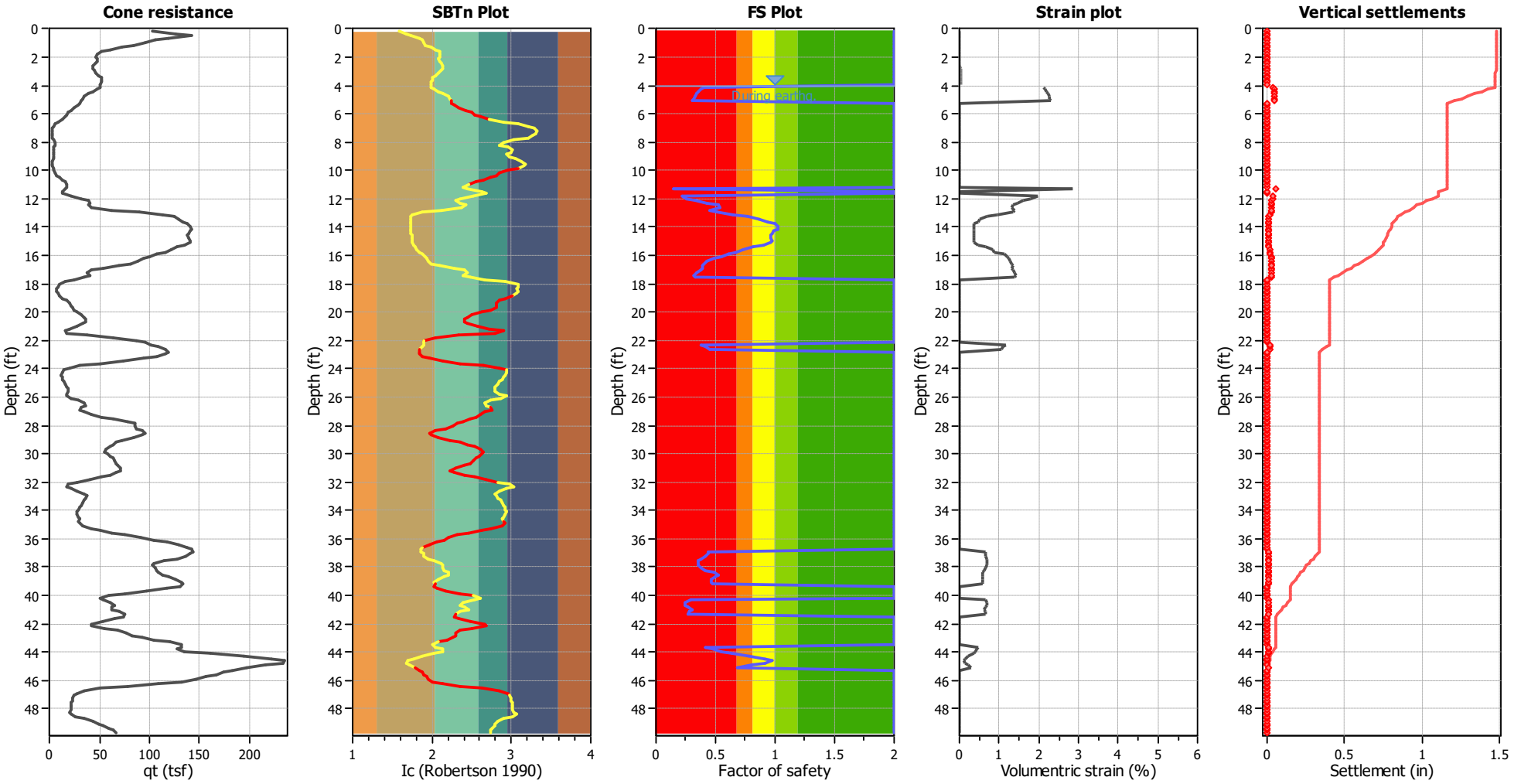




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	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:	6.72	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.70	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	8.00 ft	Fill height:	N/A	Limit depth:	60.00 ft

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.16	1.58	164.62	1.00	164.62	29	681	0.45	0.001	0.00	8.77	0.00	0.000
0.33	1.68	201.83	1.02	206.06	38	943	0.45	0.001	0.00	8.77	0.00	0.000
0.49	1.73	227.20	1.06	241.15	46	1145	0.45	0.001	0.00	8.77	0.00	0.000
0.66	1.84	191.99	1.14	217.99	43	1103	0.45	0.002	0.00	8.77	0.00	0.000
0.82	1.88	170.23	1.17	198.59	39	1025	0.45	0.003	0.00	8.77	0.00	0.000
0.98	1.89	154.20	1.18	181.92	36	946	0.45	0.004	0.00	8.77	0.00	0.000
1.15	1.92	135.93	1.21	164.07	33	865	0.45	0.005	0.00	8.77	0.00	0.000
1.31	1.98	115.40	1.27	147.05	30	793	0.45	0.006	0.00	8.77	0.00	0.000
1.48	2.05	96.91	1.37	132.50	28	726	0.45	0.008	0.01	8.77	0.00	0.000
1.64	2.09	83.66	1.43	120.02	26	660	0.45	0.011	0.01	8.77	0.01	0.000
1.80	2.10	77.01	1.45	111.92	24	616	0.45	0.014	0.01	8.77	0.01	0.000
1.97	2.09	75.33	1.44	108.43	23	596	0.45	0.017	0.01	8.77	0.01	0.000
2.13	2.08	77.30	1.42	110.12	24	605	0.45	0.018	0.02	8.77	0.01	0.000
2.30	2.09	77.12	1.43	110.62	24	608	0.45	0.020	0.02	8.77	0.01	0.000
2.46	2.11	74.05	1.47	108.98	24	600	0.45	0.023	0.02	8.77	0.01	0.001
2.62	2.13	70.50	1.51	106.45	23	585	0.44	0.027	0.02	8.77	0.02	0.001
2.79	2.14	69.30	1.52	105.68	23	581	0.44	0.030	0.03	8.77	0.02	0.001
2.95	2.12	71.11	1.49	105.81	23	582	0.44	0.033	0.03	8.77	0.02	0.001
3.12	2.08	75.00	1.42	106.17	23	583	0.44	0.036	0.03	8.77	0.02	0.001
3.28	2.04	79.64	1.35	107.54	23	588	0.44	0.038	0.03	8.77	0.02	0.001
3.44	2.01	82.79	1.31	108.84	23	592	0.44	0.041	0.03	8.77	0.03	0.001
3.61	2.00	83.63	1.30	108.90	23	591	0.44	0.044	0.04	8.77	0.03	0.001
3.77	1.99	83.29	1.29	107.35	22	581	0.44	0.050	0.04	8.77	0.03	0.001
3.94	1.98	82.15	1.28	105.02	22	567	0.44	0.058	0.05	8.77	0.04	0.002

Total estimated settlement: 0.01

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
4.10	102.66	0.40	2.13	0.93	0.04	4.27	100.16	0.38	2.16	0.93	0.04
4.43	97.80	0.36	2.20	0.92	0.04	4.59	95.64	0.34	2.24	0.92	0.04
4.76	93.99	0.33	2.26	0.92	0.04	4.92	92.50	0.31	2.28	0.92	0.04
5.09	90.99	0.30	2.31	0.91	0.05	5.25	87.53	2.00	0.00	0.91	0.00
5.41	84.05	2.00	0.00	0.91	0.00	5.58	81.28	2.00	0.00	0.91	0.00
5.74	81.77	2.00	0.00	0.90	0.00	5.91	82.40	2.00	0.00	0.90	0.00
6.07	82.73	2.00	0.00	0.90	0.00	6.23	83.52	2.00	0.00	0.89	0.00
6.40	82.40	2.00	0.00	0.89	0.00	6.56	77.56	2.00	0.00	0.89	0.00
6.73	66.42	2.00	0.00	0.89	0.00	6.89	54.54	2.00	0.00	0.88	0.00
7.05	45.87	2.00	0.00	0.88	0.00	7.22	42.36	2.00	0.00	0.88	0.00
7.38	41.65	2.00	0.00	0.87	0.00	7.55	42.92	2.00	0.00	0.87	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
7.71	45.09	2.00	0.00	0.87	0.00	7.87	46.90	2.00	0.00	0.87	0.00
8.04	46.27	2.00	0.00	0.86	0.00	8.20	44.65	2.00	0.00	0.86	0.00
8.37	43.02	2.00	0.00	0.86	0.00	8.53	42.04	2.00	0.00	0.86	0.00
8.69	41.18	2.00	0.00	0.85	0.00	8.86	41.28	2.00	0.00	0.85	0.00
9.02	41.23	2.00	0.00	0.85	0.00	9.19	41.00	2.00	0.00	0.84	0.00
9.35	39.68	2.00	0.00	0.84	0.00	9.51	38.38	2.00	0.00	0.84	0.00
9.68	37.52	2.00	0.00	0.84	0.00	9.84	37.95	2.00	0.00	0.83	0.00
10.01	39.38	2.00	0.00	0.83	0.00	10.17	43.00	2.00	0.00	0.83	0.00
10.33	51.61	2.00	0.00	0.82	0.00	10.50	62.37	2.00	0.00	0.82	0.00
10.66	70.97	2.00	0.00	0.82	0.00	10.83	73.60	2.00	0.00	0.82	0.00
10.99	71.23	2.00	0.00	0.81	0.00	11.15	64.47	2.00	0.00	0.81	0.00
11.32	60.47	0.14	2.85	0.81	0.06	11.48	65.93	2.00	0.00	0.81	0.00
11.65	80.74	2.00	0.00	0.80	0.00	11.81	92.85	0.22	1.99	0.80	0.04
11.98	103.64	0.26	1.81	0.80	0.04	12.14	117.58	0.32	1.63	0.79	0.03
12.30	134.22	0.43	1.45	0.79	0.03	12.47	147.23	0.53	1.34	0.79	0.03
12.63	148.21	0.53	1.33	0.79	0.03	12.80	138.21	0.45	1.40	0.78	0.03
12.96	145.42	0.51	1.34	0.78	0.03	13.12	161.43	0.65	0.97	0.78	0.02
13.29	172.56	0.77	0.71	0.77	0.01	13.45	180.19	0.86	0.51	0.77	0.01
13.62	186.09	0.93	0.48	0.77	0.01	13.78	190.92	1.00	0.37	0.77	0.01
13.94	193.32	1.03	0.37	0.76	0.01	14.11	192.71	1.02	0.37	0.76	0.01
14.27	190.68	0.99	0.37	0.76	0.01	14.44	189.38	0.97	0.37	0.76	0.01
14.60	188.70	0.96	0.37	0.75	0.01	14.76	188.74	0.96	0.37	0.75	0.01
14.93	190.08	0.98	0.36	0.75	0.01	15.09	189.15	0.96	0.36	0.74	0.01
15.26	184.51	0.90	0.47	0.74	0.01	15.42	177.54	0.81	0.65	0.74	0.01
15.58	170.73	0.73	0.85	0.74	0.02	15.75	164.76	0.67	0.89	0.73	0.02
15.91	158.26	0.60	1.14	0.73	0.02	16.08	151.62	0.54	1.21	0.73	0.02
16.24	144.56	0.48	1.25	0.72	0.02	16.40	137.58	0.43	1.30	0.72	0.03
16.57	132.71	0.40	1.33	0.72	0.03	16.73	130.78	0.39	1.34	0.72	0.03
16.90	131.19	0.39	1.33	0.71	0.03	17.06	129.85	0.38	1.34	0.71	0.03
17.22	124.54	0.35	1.38	0.71	0.03	17.39	119.86	0.32	1.42	0.71	0.03
17.55	122.76	0.33	1.39	0.70	0.03	17.72	125.53	2.00	0.00	0.70	0.00
17.88	120.46	2.00	0.00	0.70	0.00	18.04	102.69	2.00	0.00	0.69	0.00
18.21	83.44	2.00	0.00	0.69	0.00	18.37	73.14	2.00	0.00	0.69	0.00
18.54	72.59	2.00	0.00	0.69	0.00	18.70	76.97	2.00	0.00	0.68	0.00
18.86	86.79	2.00	0.00	0.68	0.00	19.03	100.18	2.00	0.00	0.68	0.00
19.19	115.53	2.00	0.00	0.67	0.00	19.36	128.27	2.00	0.00	0.67	0.00
19.52	138.27	2.00	0.00	0.67	0.00	19.69	141.15	2.00	0.00	0.67	0.00
19.85	131.97	2.00	0.00	0.66	0.00	20.01	117.78	2.00	0.00	0.66	0.00
20.18	105.60	2.00	0.00	0.66	0.00	20.34	102.52	2.00	0.00	0.66	0.00
20.51	101.24	2.00	0.00	0.65	0.00	20.67	100.22	2.00	0.00	0.65	0.00
20.83	99.58	2.00	0.00	0.65	0.00	21.00	101.50	2.00	0.00	0.64	0.00
21.16	101.50	2.00	0.00	0.64	0.00	21.33	103.70	2.00	0.00	0.64	0.00
21.49	98.41	2.00	0.00	0.64	0.00	21.65	89.08	2.00	0.00	0.63	0.00
21.82	96.70	2.00	0.00	0.63	0.00	21.98	113.80	2.00	0.00	0.63	0.00
22.15	124.25	2.00	0.00	0.62	0.00	22.31	131.02	0.37	1.16	0.62	0.02
22.47	137.50	0.41	1.11	0.62	0.02	22.64	142.85	0.45	1.07	0.62	0.02
22.80	144.65	2.00	0.00	0.61	0.00	22.97	141.54	2.00	0.00	0.61	0.00
23.13	134.28	2.00	0.00	0.61	0.00	23.29	126.07	2.00	0.00	0.61	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
23.46	119.22	2.00	0.00	0.60	0.00	23.62	117.81	2.00	0.00	0.60	0.00
23.79	120.34	2.00	0.00	0.60	0.00	23.95	111.07	2.00	0.00	0.59	0.00
24.11	95.13	2.00	0.00	0.59	0.00	24.28	79.77	2.00	0.00	0.59	0.00
24.44	71.64	2.00	0.00	0.59	0.00	24.61	70.44	2.00	0.00	0.58	0.00
24.77	73.05	2.00	0.00	0.58	0.00	24.93	77.61	2.00	0.00	0.58	0.00
25.10	83.16	2.00	0.00	0.57	0.00	25.26	87.66	2.00	0.00	0.57	0.00
25.43	88.88	2.00	0.00	0.57	0.00	25.59	87.83	2.00	0.00	0.57	0.00
25.75	91.88	2.00	0.00	0.56	0.00	25.92	101.36	2.00	0.00	0.56	0.00
26.08	114.24	2.00	0.00	0.56	0.00	26.25	126.33	2.00	0.00	0.56	0.00
26.41	136.03	2.00	0.00	0.55	0.00	26.57	139.69	2.00	0.00	0.55	0.00
26.74	137.86	2.00	0.00	0.55	0.00	26.90	131.38	2.00	0.00	0.54	0.00
27.07	131.21	2.00	0.00	0.54	0.00	27.23	142.73	2.00	0.00	0.54	0.00
27.40	160.10	2.00	0.00	0.54	0.00	27.56	171.19	2.00	0.00	0.53	0.00
27.72	175.79	2.00	0.00	0.53	0.00	27.89	170.18	2.00	0.00	0.53	0.00
28.05	155.86	2.00	0.00	0.52	0.00	28.22	135.71	2.00	0.00	0.52	0.00
28.38	122.62	2.00	0.00	0.52	0.00	28.54	116.57	2.00	0.00	0.52	0.00
28.71	115.03	2.00	0.00	0.51	0.00	28.87	116.10	2.00	0.00	0.51	0.00
29.04	122.48	2.00	0.00	0.51	0.00	29.20	135.51	2.00	0.00	0.51	0.00
29.36	152.29	2.00	0.00	0.50	0.00	29.53	171.40	2.00	0.00	0.50	0.00
29.69	183.01	2.00	0.00	0.50	0.00	29.86	187.58	2.00	0.00	0.49	0.00
30.02	186.25	2.00	0.00	0.49	0.00	30.18	184.41	2.00	0.00	0.49	0.00
30.35	181.23	2.00	0.00	0.49	0.00	30.51	176.00	2.00	0.00	0.48	0.00
30.68	166.81	2.00	0.00	0.48	0.00	30.84	146.36	2.00	0.00	0.48	0.00
31.00	124.60	2.00	0.00	0.47	0.00	31.17	111.28	2.00	0.00	0.47	0.00
31.33	116.10	2.00	0.00	0.47	0.00	31.50	128.90	2.00	0.00	0.47	0.00
31.66	135.72	2.00	0.00	0.46	0.00	31.82	133.00	2.00	0.00	0.46	0.00
31.99	118.99	2.00	0.00	0.46	0.00	32.15	104.02	2.00	0.00	0.46	0.00
32.32	97.58	2.00	0.00	0.45	0.00	32.48	107.92	2.00	0.00	0.45	0.00
32.64	123.87	2.00	0.00	0.45	0.00	32.81	141.12	2.00	0.00	0.44	0.00
32.97	152.12	2.00	0.00	0.44	0.00	33.14	156.86	2.00	0.00	0.44	0.00
33.30	154.50	2.00	0.00	0.44	0.00	33.46	151.51	2.00	0.00	0.43	0.00
33.63	146.75	2.00	0.00	0.43	0.00	33.79	142.14	2.00	0.00	0.43	0.00
33.96	134.06	2.00	0.00	0.42	0.00	34.12	128.61	2.00	0.00	0.42	0.00
34.28	127.19	2.00	0.00	0.42	0.00	34.45	128.49	2.00	0.00	0.42	0.00
34.61	131.54	2.00	0.00	0.41	0.00	34.78	133.09	2.00	0.00	0.41	0.00
34.94	139.32	2.00	0.00	0.41	0.00	35.10	144.35	2.00	0.00	0.41	0.00
35.27	145.03	2.00	0.00	0.40	0.00	35.43	143.89	2.00	0.00	0.40	0.00
35.60	131.80	2.00	0.00	0.40	0.00	35.76	127.61	2.00	0.00	0.39	0.00
35.93	127.20	2.00	0.00	0.39	0.00	36.09	134.74	2.00	0.00	0.39	0.00
36.25	136.77	2.00	0.00	0.39	0.00	36.42	136.88	2.00	0.00	0.38	0.00
36.58	137.61	2.00	0.00	0.38	0.00	36.75	139.80	2.00	0.00	0.38	0.00
36.91	140.05	0.44	0.66	0.37	0.01	37.07	139.26	0.44	0.66	0.37	0.01
37.24	135.31	0.41	0.67	0.37	0.01	37.40	130.65	0.38	0.69	0.37	0.01
37.57	126.14	0.35	0.70	0.36	0.01	37.73	126.12	0.35	0.70	0.36	0.01
37.89	126.92	0.36	0.69	0.36	0.01	38.06	130.78	0.38	0.67	0.35	0.01
38.22	136.91	0.42	0.64	0.35	0.01	38.39	146.70	0.49	0.60	0.35	0.01
38.55	151.22	0.53	0.58	0.35	0.01	38.71	147.44	0.50	0.58	0.34	0.01
38.88	143.20	0.47	0.59	0.34	0.01	39.04	142.30	0.46	0.59	0.34	0.01

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
39.21	144.97	0.48	0.58	0.34	0.01	39.37	140.52	2.00	0.00	0.33	0.00
39.53	129.92	2.00	0.00	0.33	0.00	39.70	119.56	2.00	0.00	0.33	0.00
39.86	120.81	2.00	0.00	0.32	0.00	40.03	125.55	2.00	0.00	0.32	0.00
40.19	125.98	2.00	0.00	0.32	0.00	40.35	113.95	0.29	0.66	0.32	0.01
40.52	103.58	0.24	0.71	0.31	0.01	40.68	102.57	0.24	0.71	0.31	0.01
40.85	109.81	0.27	0.67	0.31	0.01	41.01	116.52	0.30	0.63	0.30	0.01
41.17	112.33	0.28	0.64	0.30	0.01	41.34	108.67	0.27	0.65	0.30	0.01
41.50	102.82	2.00	0.00	0.30	0.00	41.67	101.17	2.00	0.00	0.29	0.00
41.83	102.97	2.00	0.00	0.29	0.00	41.99	109.14	2.00	0.00	0.29	0.00
42.16	112.52	2.00	0.00	0.29	0.00	42.32	108.96	2.00	0.00	0.28	0.00
42.49	107.05	2.00	0.00	0.28	0.00	42.65	110.76	2.00	0.00	0.28	0.00
42.81	118.18	2.00	0.00	0.27	0.00	42.98	125.45	2.00	0.00	0.27	0.00
43.14	127.18	2.00	0.00	0.27	0.00	43.31	127.39	2.00	0.00	0.27	0.00
43.47	130.56	2.00	0.00	0.26	0.00	43.64	134.88	0.42	0.48	0.26	0.01
43.80	143.14	0.48	0.45	0.26	0.01	43.96	152.25	0.55	0.42	0.25	0.01
44.13	161.13	0.63	0.38	0.25	0.01	44.29	174.68	0.78	0.22	0.25	0.00
44.46	185.53	0.91	0.15	0.25	0.00	44.62	189.68	0.97	0.12	0.24	0.00
44.78	185.59	0.92	0.15	0.24	0.00	44.95	176.62	0.81	0.21	0.24	0.00
45.11	165.65	0.68	0.28	0.24	0.01	45.28	157.62	2.00	0.00	0.23	0.00
45.44	153.03	2.00	0.00	0.23	0.00	45.60	148.80	2.00	0.00	0.23	0.00
45.77	141.91	2.00	0.00	0.22	0.00	45.93	134.04	2.00	0.00	0.22	0.00
46.10	125.76	2.00	0.00	0.22	0.00	46.26	118.46	2.00	0.00	0.22	0.00
46.42	115.51	2.00	0.00	0.21	0.00	46.59	115.49	2.00	0.00	0.21	0.00
46.75	107.60	2.00	0.00	0.21	0.00	46.92	96.33	2.00	0.00	0.20	0.00
47.08	88.39	2.00	0.00	0.20	0.00	47.24	85.25	2.00	0.00	0.20	0.00
47.41	84.41	2.00	0.00	0.20	0.00	47.57	84.01	2.00	0.00	0.19	0.00
47.74	83.00	2.00	0.00	0.19	0.00	47.90	81.83	2.00	0.00	0.19	0.00
48.06	80.03	2.00	0.00	0.19	0.00	48.23	80.08	2.00	0.00	0.18	0.00
48.39	85.21	2.00	0.00	0.18	0.00	48.56	97.20	2.00	0.00	0.18	0.00
48.72	112.51	2.00	0.00	0.17	0.00	48.88	127.57	2.00	0.00	0.17	0.00
49.05	139.04	2.00	0.00	0.17	0.00	49.21	148.80	2.00	0.00	0.17	0.00
49.38	157.39	2.00	0.00	0.16	0.00	49.54	165.52	2.00	0.00	0.16	0.00
49.70	170.66	2.00	0.00	0.16	0.00						

Total estimated settlement: 1.47

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

APPENDIX E

GENERAL GRADING GUIDELINES

Updated Geotechnical Evaluation
Orange Avenue Seniors, Cypress, California
Project No. 2573-CR

GEOTEK

GENERAL GRADING GUIDELINES

Guidelines presented herein are intended to address general construction procedures for earthwork construction. Specific situations and conditions often arise which cannot reasonably be discussed in general guidelines, when anticipated these are discussed in the text of the report. Often unanticipated conditions are encountered which may necessitate modification or changes to these guidelines. It is our hope that these will assist the contractor to more efficiently complete the project by providing a reasonable understanding of the procedures that would be expected during earthwork and the testing and observation used to evaluate those procedures.

General

Grading should be performed to at least the minimum requirements of governing agencies, Chapters 18 and 33 of the California Building Code, CBC (2019) and the guidelines presented below.

Preconstruction Meeting

A preconstruction meeting should be held prior to site earthwork. Any questions the contractor has regarding our recommendations, general site conditions, apparent discrepancies between reported and actual conditions and/or differences in procedures the contractor intends to use should be brought up at that meeting. The contractor (including the main onsite representative) should review our report and these guidelines in advance of the meeting. Any comments the contractor may have regarding these guidelines should be brought up at that meeting.

Grading Observation and Testing

1. Observation of the fill placement should be provided by our representative during grading. Verbal communication during the course of each day will be used to inform the contractor of test results. The contractor should receive a copy of the "Daily Field Report" indicating results of field density tests that day. If our representative does not provide the contractor with these reports, our office should be notified.
2. Testing and observation procedures are, by their nature, specific to the work or area observed and location of the tests taken, variability may occur in other locations. The contractor is responsible for the uniformity of the grading operations; our observations and test results are intended to evaluate the contractor's overall level of efforts during grading. The contractor's personnel are the only individuals participating in all aspect of site work. Compaction testing and observation should not be considered as relieving the contractor's responsibility to properly compact the fill.
3. Cleanouts, processed ground to receive fill, key excavations, and subdrains should be observed by our representative prior to placing any fill. It will be the contractor's responsibility to notify our representative or office when such areas are ready for observation.
4. Density tests may be made on the surface material to receive fill, as considered warranted by this firm.
5. In general, density tests would be made at maximum intervals of two feet of fill height or every 1,000 cubic yards of fill placed. Criteria will vary depending on soil conditions and size of the fill. More frequent testing may be performed. In any case, an adequate number of field density tests should be made to evaluate the required compaction and moisture content is generally being obtained.

6. Laboratory testing to support field test procedures will be performed, as considered warranted, based on conditions encountered (e.g. change of material sources, types, etc.) Every effort will be made to process samples in the laboratory as quickly as possible and in progress construction projects are our first priority. However, laboratory workloads may cause in delays and some soils may require a **minimum of 48 to 72 hours to complete test procedures**. Whenever possible, our representative(s) should be informed in advance of operational changes that might result in different source areas for materials.
7. Procedures for testing of fill slopes are as follows:
   a) Density tests should be taken periodically during grading on the flat surface of the fill, three to five feet horizontally from the face of the slope.
   b) If a method other than over building and cutting back to the compacted core is to be employed, slope compaction testing during construction should include testing the outer six inches to three feet in the slope face to determine if the required compaction is being achieved.
8. Finish grade testing of slopes and pad surfaces should be performed after construction is complete.

Site Clearing

1. All vegetation, and other deleterious materials, should be removed from the site. If material is not immediately removed from the site it should be stockpiled in a designated area(s) well outside of all current work areas and delineated with flagging or other means. Site clearing should be performed in advance of any grading in a specific area.
2. Efforts should be made by the contractor to remove all organic or other deleterious material from the fill, as even the most diligent efforts may result in the incorporation of some materials. This is especially important when grading is occurring near the natural grade. All equipment operators should be aware of these efforts. Laborers may be required as root pickers.
3. Nonorganic debris or concrete may be placed in deeper fill areas provided the procedures used are observed and found acceptable by our representative.

Treatment of Existing Ground

1. Following site clearing, all surficial deposits of alluvium and colluvium as well as weathered or creep effected bedrock, should be removed unless otherwise specifically indicated in the text of this report.
2. In some cases, removal may be recommended to a specified depth (e.g. flat sites where partial alluvial removals may be sufficient). The contractor should not exceed these depths unless directed otherwise by our representative.
3. Groundwater existing in alluvial areas may make excavation difficult. Deeper removals than indicated in the text of the report may be necessary due to saturation during winter months.
4. Subsequent to removals, the natural ground should be processed to a depth of six inches, moistened to near optimum moisture conditions and compacted to fill standards.
5. Exploratory back hoe or dozer trenches still remaining after site removal should be excavated and filled with compacted fill if they can be located.

Fill Placement

1. Unless otherwise indicated, all site soil and bedrock may be reused for compacted fill; however, some special processing or handling may be required (see text of report).

2. Material used in the compacting process should be evenly spread, moisture conditioned, processed, and compacted in thin lifts six (6) to eight (8) inches in compacted thickness to obtain a uniformly dense layer. The fill should be placed and compacted on a nearly horizontal plane, unless otherwise found acceptable by our representative.
3. If the moisture content or relative density varies from that recommended by this firm, the contractor should rework the fill until it is in accordance with the following:
    a) Moisture content of the fill should be at or above optimum moisture. Moisture should be evenly distributed without wet and dry pockets. Pre-watering of cut or removal areas should be considered in addition to watering during fill placement, particularly in clay or dry surficial soils. The ability of the contractor to obtain the proper moisture content will control production rates.
    b) Each six-inch layer should be compacted to at least 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency. In most cases, the testing method is ASTM Test Designation D 1557.
4. Rock fragments less than eight inches in diameter may be utilized in the fill, provided:
    a) They are not placed in concentrated pockets;
    b) There is a sufficient percentage of fine-grained material to surround the rocks;
    c) The distribution of the rocks is observed by, and acceptable to, our representative.
5. Rocks exceeding eight (8) inches in diameter should be taken off site, broken into smaller fragments, or placed in accordance with recommendations of this firm in areas designated suitable for rock disposal. On projects where significant large quantities of oversized materials are anticipated, alternate guidelines for placement may be included. If significant oversize materials are encountered during construction, these guidelines should be requested.
6. In clay soil, dry or large chunks or blocks are common. If in excess of eight (8) inches minimum dimension, then they are considered as oversized. Sheepsfoot compactors or other suitable methods should be used to break up blocks. When dry, they should be moisture conditioned to provide a uniform condition with the surrounding fill.

Slope Construction

1. The contractor should obtain a minimum relative compaction of 90 percent out to the finished slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment.
2. Slopes trimmed to the compacted core should be overbuilt by at least three (3) feet with compaction efforts out to the edge of the false slope. Failure to properly compact the outer edge results in trimming not exposing the compacted core and additional compaction after trimming may be necessary.
3. If fill slopes are built "at grade" using direct compaction methods, then the slope construction should be performed so that a constant gradient is maintained throughout construction. Soil should not be "spilled" over the slope face nor should slopes be "pushed out" to obtain grades. Compaction equipment should compact each lift along the immediate top of slope. Slopes should be back rolled or otherwise compacted at approximately every 4 feet vertically as the slope is built.
4. Corners and bends in slopes should have special attention during construction as these are the most difficult areas to obtain proper compaction.
5. Cut slopes should be cut to the finished surface. Excessive undercutting and smoothing of the face with fill may necessitate stabilization.

UTILITY TRENCH CONSTRUCTION AND BACKFILL

Utility trench excavation and backfill is the contractors responsibility. The geotechnical consultant typically provides periodic observation and testing of these operations. While efforts are made to make sufficient observations and tests to verify that the contractors' methods and procedures are adequate to achieve proper compaction, it is typically impractical to observe all backfill procedures. As such, it is critical that the contractor use consistent backfill procedures.

Compaction methods vary for trench compaction and experience indicates many methods can be successful. However, procedures that "worked" on previous projects may or may not prove effective on a given site. The contractor(s) should outline the procedures proposed, so that we may discuss them **prior** to construction. We will offer comments based on our knowledge of site conditions and experience.

1. Utility trench backfill in slopes, structural areas, in streets and beneath flat work or hardscape should be brought to at least optimum moisture and compacted to at least 90 percent of the laboratory standard. Soil should be moisture conditioned prior to placing in the trench.
2. Flooding and jetting are not typically recommended or acceptable for native soils. Flooding or jetting may be used with select sand having a Sand Equivalent (SE) of 30 or higher. This is typically limited to the following uses:
   a) shallow (12 + inches) under slab interior trenches and,
   b) as bedding in pipe zone.

   The water should be allowed to dissipate prior to pouring slabs or completing trench compaction.
3. Care should be taken not to place soils at high moisture content within the upper three feet of the trench backfill in street areas, as overly wet soils may impact subgrade preparation. Moisture may be reduced to 2% below optimum moisture in areas to be paved within the upper three feet below sub grade.
4. Sand backfill should not be allowed in exterior trenches adjacent to and within an area extending below a 1:1 projection from the outside bottom edge of a footing, unless it is similar to the surrounding soil.
5. Trench compaction testing is generally at the discretion of the geotechnical consultant. Testing frequency will be based on trench depth and the contractors procedures. A probing rod would be used to assess the consistency of compaction between tested areas and untested areas. If zones are found that are considered less compact than other areas, this would be brought to the contractors attention.

JOB SAFETY

General

Personnel safety is a primary concern on all job sites. The following summaries are safety considerations for use by all our employees on multi-employer construction sites. On ground personnel are at highest risk of injury and possible fatality on grading construction projects. The company recognizes that construction activities will vary on each site and that job site safety is the contractor's responsibility. However, it is, imperative that all personnel be safety conscious to avoid accidents and potential injury.

In an effort to minimize risks associated with geotechnical testing and observation, the following precautions are to be implemented for the safety of our field personnel on grading and construction projects.

1. Safety Meetings: Our field personnel are directed to attend the contractor's regularly scheduled safety meetings.
2. Safety Vests: Safety vests are provided for and are to be worn by our personnel while on the job site.
3. Safety Flags: Safety flags are provided to our field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

In the event that the contractor's representative observes any of our personnel not following the above, we request that it be brought to the attention of our office.

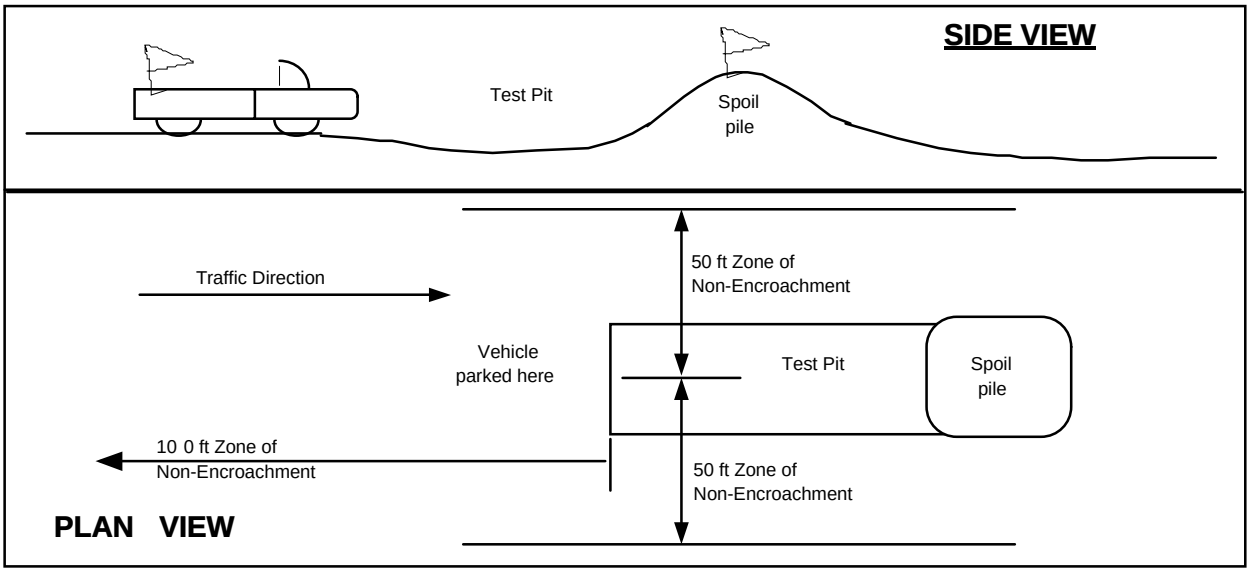
Test Pits Location, Orientation and Clearance

The technician is responsible for selecting test pit locations. The primary concern is the technician's safety. However, it is necessary to take sufficient tests at various locations to obtain a representative sampling of the fill. As such, efforts will be made to coordinate locations with the grading contractors authorized representatives (e.g. dump man, operator, supervisor, grade checker, etc.), and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractors authorized representative should direct excavation of the pit and safety during the test period. Again, safety is the paramount concern.

Test pits should be excavated so that the spoil pile is placed away from oncoming traffic. The technician's vehicle is to be placed next to the test pit, opposite the spoil pile. This necessitates that the fill be maintained in a drivable condition. Alternatively, the contractor may opt to park a piece of equipment in front of test pits, particularly in small fill areas or those with limited access.

A zone of non-encroachment should be established for all test pits (see diagram below). No grading equipment should enter this zone during the test procedure. The zone should extend outward to the sides approximately 50 feet from the center of the test pit and 100 feet in the direction of traffic flow. This zone is established both for safety and to avoid excessive ground vibration, which typically decreases test results.

TEST PIT SAFETY PLAN



Slope Tests

When taking slope tests, the technician should park their vehicle directly above or below the test location on the slope. The contractor's representative should effectively keep all equipment at a safe operation distance (e.g. 50 feet) away from the slope during testing.

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location.

Trench Safety

It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed. Trenches for all utilities should be excavated in accordance with CAL-OSHA and any other applicable safety standards. Safe conditions will be required to enable compaction testing of the trench backfill.

All utility trench excavations in excess of 5 feet deep, which a person enters, are to be shored or laid back. Trench access should be provided in accordance with OSHA standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

Our personnel are directed not to enter any excavation which;

1. is 5 feet or deeper unless shored or laid back,
2. exit points or ladders are not provided,
3. displays any evidence of instability, has any loose rock or other debris which could fall into the trench, or
4. displays any other evidence of any unsafe conditions regardless of depth.

If the contractor fails to provide safe access to trenches for compaction testing, our company policy requires that the soil technician withdraws and notifies their supervisor. The contractors representative will then be contacted in an effort to effect a solution. All backfill not tested due to safety concerns or other reasons is subject to reprocessing and/or removal.

Procedures

In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is directed to inform both the developer's and contractor's representatives. If the condition is not rectified, the technician is required, by company policy, to immediately withdraw and notify their supervisor. The contractor's representative will then be contacted in an effort to effect a solution. No further testing will be performed until the situation is rectified. Any fill placed in the interim can be considered unacceptable and subject to reprocessing, recompaction or removal.

In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to technicians attention and notify our project manager or office. Effective communication and coordination between the contractors' representative and the field technician(s) is strongly encouraged in order to implement the above safety program and safety in general.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

ATTACHMENT F

Notice of Transfer of Responsibility

Water Quality Management Plan
Notice of Transfer of Responsibility

Submission of this Notice of Transfer of Responsibility constitutes notice to the City of Cypress 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 Responsibility Party Information

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

II. Information about Site Transferred

Name of Project	
Title of WQMP Applicable to Site:	
Street Address of Site	
Tract Number(s) for Site	Lot Numbers
Date WQMP Prepared (or Revised)	

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 Number(s) of Site Transferred to New Owner	
Remaining Lot/ Tract Number(s) 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 the 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 the Previous Owner. Those portions retained by the Previous Owner shall be labeled "Previous Owner," and those portions previously transferred by the 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 Owner is now the Responsible Party of record for the WQMP for this 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 New Owner.

Print 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.

Print Name of New Owner Representative	Title
Signature of New Owner Representative	Date

ATTACHMENT G

Educational Materials

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

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.

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

Orange County Stormwater Program

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
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On-line Water Pollution Problem Reporting Form
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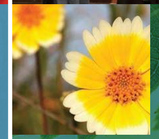

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In Orange County, 60-70% of water used by residents and businesses goes to irrigation and other outdoor uses. Reusing rainwater to irrigate our lawn not only reduces the impact of water pollution from runoff, but it also is a great way to conserve our precious water resources and replenish our groundwater basin.

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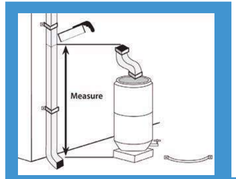

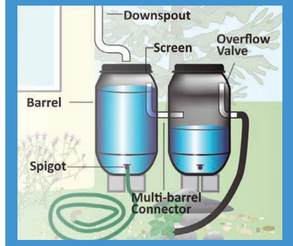

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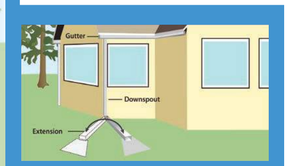
Rain gardens allow runoff to be directed from your roof downspout into a landscaped area. Vegetation and rocks in the garden will slow the flow of water to allow for infiltration into the soil. Plants and soil particles will absorb pollutants from the roof runoff. By utilizing a native plant palate, rain gardens can be maintained all year with minimal additional irrigation. These plants are adapted to the semi-arid climate of Southern California, require less water and can reduce your water bill.

Before modifying your yard to install a rain garden, please consult your local building and/or planning departments to ensure your garden plan follows pertinent building codes and ordinances. Besides codes and ordinances, some home owner associations also have guidelines for yard modifications. If your property is in hill areas or includes engineered slopes, please seek professional advice before proceeding with changes.



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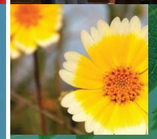

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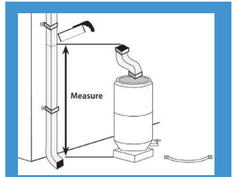

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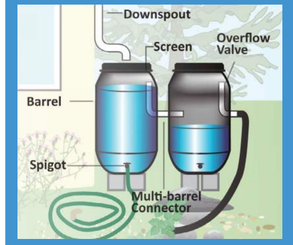

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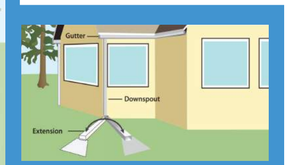

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Do your part to prevent water pollution in our creeks, rivers, bays and ocean.

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common household activities can lead to water pollution if you're not careful.

Remember the Water in Your Storm Drain is Not Treated BEFORE It Enters Our Waterways

Litter, oil, chemicals and other substances that are left on your yard or driveway can be blown or washed into storm drains that flow to the ocean. Over-watering your lawn and washing your car can also flush materials into the storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated.

You would never pour soap, fertilizers or oil into the ocean, so don't let them enter streets, gutters or storm drains. Follow the easy tips in this brochure to help prevent water pollution.

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For emergencies, dial 911.

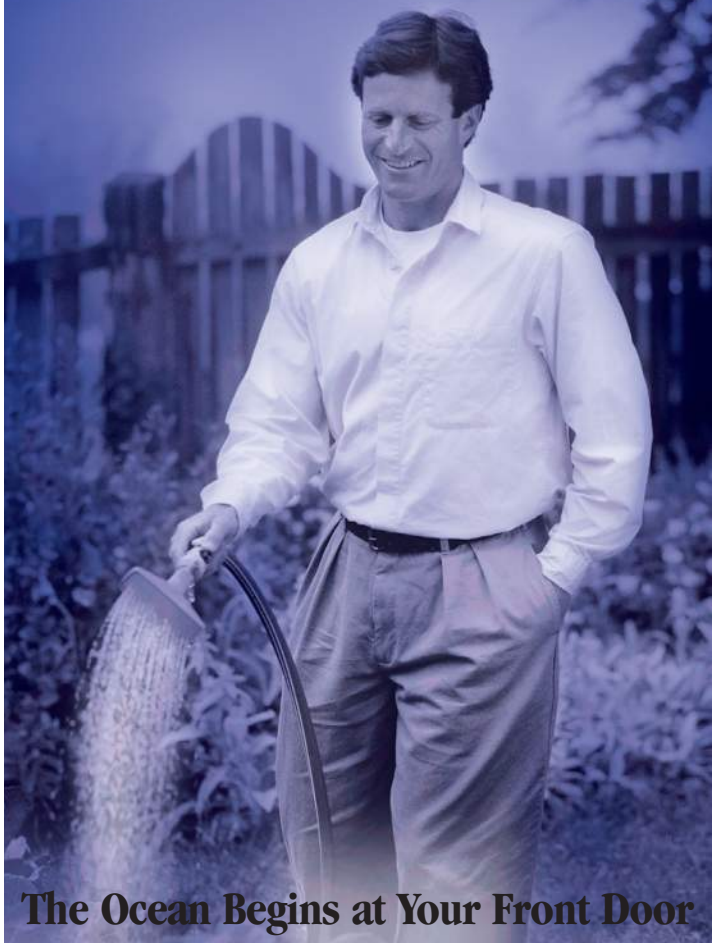
The tips contained in this brochure provide useful information to help prevent water pollution while performing everyday household activities. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

GENUINE RECYCLED PAPER
50% PRE-CONSUMER AND 15% POST-CONSUMER

RECYCLE USED OIL

Help Prevent Ocean Pollution:

Household Tips



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PROJECT Pollution PREVENTION

Pollution Prevention

Household Activities

- **Do not rinse spills with water!** Sweep outdoor spills and dispose of in the trash. For wet spills like oil, apply cat litter or another absorbent material, then sweep and bring to a household hazardous waste collection center (HHWCC).
- Securely cover trash cans.
- Take household hazardous waste to a household hazardous waste collection center.
- Store household hazardous waste in closed, labeled containers inside or under a cover.
- Do not hose down your driveway, sidewalk or patio. Sweep up debris and dispose of in trash.
- Always pick up after your pet. Flush waste down the toilet or dispose of in the trash.
- Bathe pets indoors or have them professionally groomed.

Household Hazardous Wastes include:

- ▲ **Batteries**
- ▲ **Paint thinners, paint strippers and removers**
- ▲ **Adhesives**
- ▲ **Drain openers**
- ▲ **Oven cleaners**
- ▲ **Wood and metal cleaners and polishes**
- ▲ **Herbicides and pesticides**
- ▲ **Fungicides/wood preservatives**
- ▲ **Automotive fluids and products**
- ▲ **Grease and rust solvents**
- ▲ **Thermometers and other products containing mercury**
- ▲ **Fluorescent lamps**
- ▲ **Cathode ray tubes, e.g. TVs, computer monitors**
- ▲ **Pool and spa chemicals**

Gardening Activities

- Follow directions on pesticides and fertilizers, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Water your lawn and garden by hand to control the amount of water you use. Set irrigation systems to reflect seasonal water needs. If water flows off your yard and onto your driveway or sidewalk, your system is over-watering.
- Mulch clippings or leave them on the lawn. If necessary, dispose in a green waste container.
- Cultivate your garden often to control weeds.

Washing and Maintaining Your Car

- Take your car to a commercial car wash whenever possible.
- Choose soaps, cleaners, or detergents labeled "non-toxic," "phosphate free" or "biodegradable." Vegetable and citrus-based products are typically safest for the environment, **but even these should not be allowed into the storm drain.**
- Shake floor mats into a trash can or vacuum to clean.
- Do not use acid-based wheel cleaners and "hose off" engine degreasers at home. They can be used at a commercial facility, which can properly process the washwater.
- **Do not dump washwater onto your driveway, sidewalk, street, gutter or storm drain.** Excess washwater should be disposed of in the sanitary sewers (through a sink, or toilet) or onto an absorbent surface like your lawn.
- Use a nozzle to turn off water when not actively washing down automobile.
- Monitor vehicles for leaks and place pans under leaks. Keep your car well maintained to stop and prevent leaks.
- Use cat litter or other absorbents and sweep to remove any materials deposited by vehicles. Contain sweepings and dispose of at a HHWCC.
- Perform automobile repair and maintenance under a covered area and use drip pans or plastic sheeting to keep spills and waste material from reaching storm drains.
- **Never pour oil or antifreeze in the street, gutter or storm drains.** Recycle these substances at a service station, HHWCC, or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.ciwmb.ca.gov/UsedOil.

For locations and hours of Household Hazardous Waste Collection Centers in Anaheim, Huntington Beach, Irvine and San Juan Capistrano, call (714)834-6752 or visit www.oclandfills.com.

HOMEOWNER TIPS
PROTECTING WATER

Before Buying Pest Control Products

- Identify the pest.
- Decide if pest control products are the best control measure or if there are alternatives available.
- Are integrated pest management guidelines available for this pest?
- Read the product label:
  - Is the pest listed on the label?
  - Is it the best product for the pest?

Before Mixing Your Sprayer

- Read the label carefully.
- Buy only enough pesticide to treat the area affected by the pest.
- Check the weather and don't apply if it's windy or about to rain
- Measure the area you're treating.
- Calculate how much spray to mix.
- Wear long sleeve shirt, long pants, shoes and any other protective equipment listed on the label and follow all the label precautions.
- Be prepared for spills and know how to clean them up.

When You're Ready To Spray

- Mix and load spray in an area where any spilled pesticide will not be able to drain or be washed away into storm drains, ditches, streams, ponds or other bodies of water.
- Mix sprayer on grass, not the sidewalk or driveway.
- Mix only as much as needed.

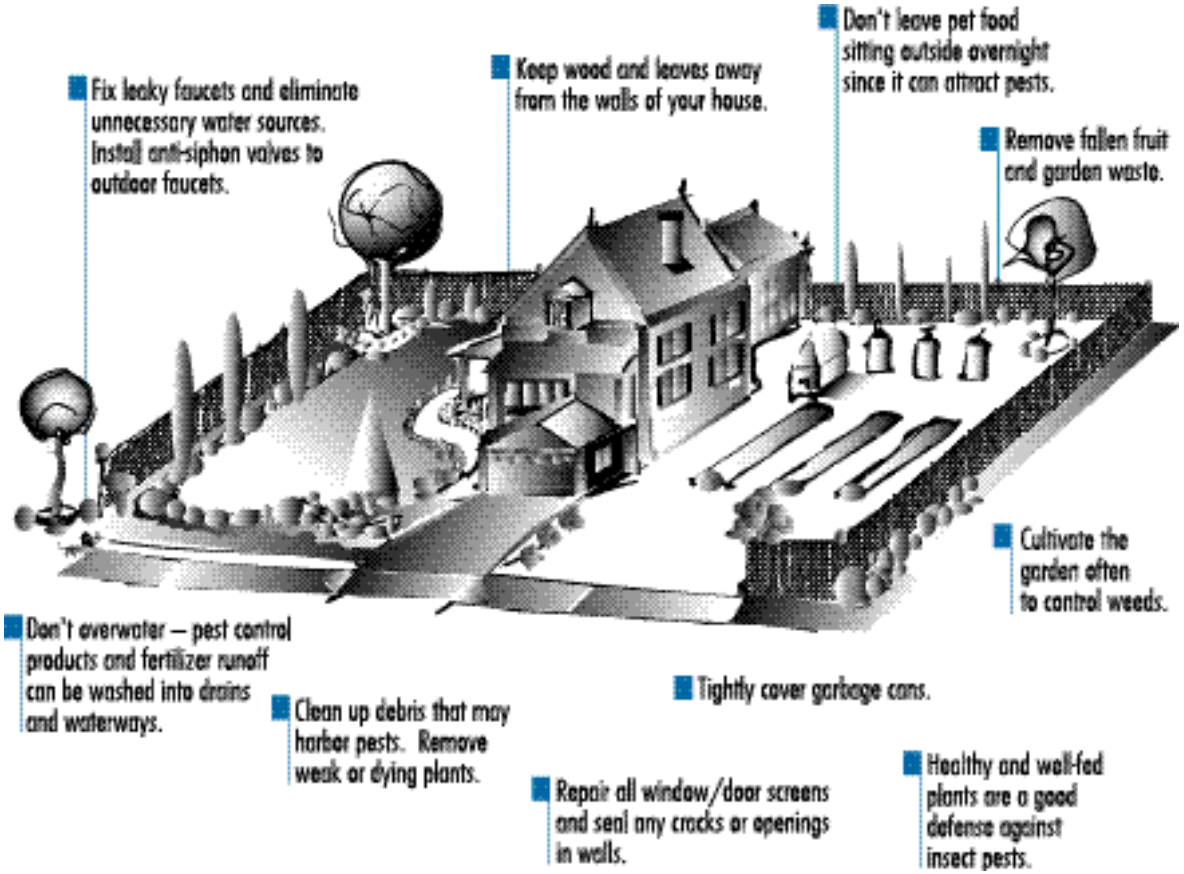
When You're Spraying

- AVOID spraying in or near storm drains, ditches, streams, and ponds!
- Leave an untreated strip around these areas to protect the water.

When You're done

- Never dump leftovers down any drain; Save for a future application.
- Triple-rinse sprayer and apply rinsewater to treated area.
- Take any old or unwanted pesticides to a Household Hazardous Waste Collection Center (714) 834-6752.

Using Pest Control Products. It's Your Responsibility To Do It Right!



IPM... Outsmarting Pests While Protecting Water

With Integrated Pest Management (IPM), homeowners use common sense and nature to make it difficult for pests to survive. IPM techniques include cultural practices (such as mulching to prevent weeds), encouraging natural enemies (good bugs), and judicious use of pest control products.

- First, identify your pest problem. To find the best solution, you need to pin down the problem. Consult gardening books, your county cooperative extension office or your local nursery.
- Decide how much pest control is necessary. If you can live with some pest damage, you can avoid intensive pest control product treatments.
- Choose an effective option. Try various types of controls first: washing bugs off plants, pruning diseased parts of plants. If you need to use pest control products, choose one that targets the problem and poses the least hazard.
- Finally, it's easier to prevent pests than to control them.

Think ahead.

This brochure is being distributed in order to reduce the impacts of pesticides on water quality. It was produced with support from the Orange County Storm Water Program, the Coalition for Urban/Rural Environmental Stewardship (CURES) and a 319(h) grant from the State Water Resources Control Board.

Orange County Storm Water Program Participants:

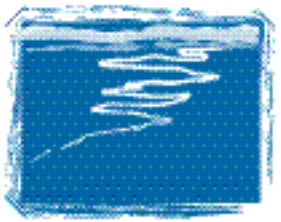
Anaheim Public Works/Engineering	(714) 765-5176
Brea Engineering	(714) 990-7666
Buena Park Public Works	(714) 562-3655
Costa Mesa Public Services	(714) 754-5248
Cypress Engineering	(714) 229-6752
Dana Point Public Works	(949) 248-3562
Fountain Valley Public Works	(714) 593-4400 x347
Fullerton Engineering Dept	(714) 738-6853
Garden Grove Development Services	(714) 741-5554
Huntington Beach Public Works	(714) 536-5432
Irvine Public Works	(949)724-6515
La Habra Public Services	(562) 905-9792
La Palma Public Works	(714) 523-1140 x102
Laguna Beach Municipal Services	(949) 497-0711
Laguna Hills Engineering	(949) 707-2600
Laguna Niguel Public Works	(949) 362-4337
Lake Forest Public Works	(949) 461-3480
Los Alamitos Community Dev	(562) 431-3538 x301
Mission Viejo Public Works	(949) 470-3095
Newport Beach Public works	(949) 644-3311
Orange Public Works	(714) 744-5551
Placentia Engineering	(714) 993-8131
San Clemente Engineering	(949) 361-6100
San Juan Capistrano Engineering	(949) 493-1171
Santa Ana Public Works	(714) 647-3380
Seal Beach Engineering	(562) 431-2527 x318
Stanton Public Works	(714) 379-9222 x204
Tustin Public Works Engineering	(714) 573-3150
Villa Park Engineering	(714) 998-1500
Westminster Public Works Eng.	(714) 898-3311 x215
Yorba Linda Engineering	(714) 961-7170 x174
O.C. Storm Water Program	1-877-89-SPILL (1-877-897-7455)
24 Hour Water Pollution Hotline	(714) 567-6363 or ashbyk@pfrd.co.orange.ca.us
Chemical and Hazardous Material Spill Emergencies	911

Other Important Phone Numbers:

For Additional Brochures	1-877-89-SPILL (1-877-897-7455)
UC Masters & Coop Extension	(714) 708-1646 ucmastergardeners@yahoo.com
O.C. Household Hazardous Waste Information	(714) 834-6752 or www.oc.ca.gov/IWMD
Information on agriculture chemicals, pesticides and possible alternatives, O.C. Agriculture Commissioner	(714) 447-7115

Original graphics developed with support from:
Coalition For Urban/Rural Environmental Stewardship (CURES)
Western Crop Protection Association (WCPA)
Responsible Industry for a Sound Environment (RISE)

Keeping Pest Control Products Out of Creeks, Rivers and The Ocean



HOMEOWNER TIPS

PROTECTING WATER

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

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

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

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

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

For emergencies, dial 911.

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

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

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Help Prevent Ocean Pollution:

Responsible Pest Control

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

Sewage Spill Regulatory Requirements

Allowing sewage to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up efforts.

Here are the pertinent codes, fines, and agency contact information that apply.

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

- County and city water quality ordinances prohibit discharges containing pollutants.

Orange County Health Care Agency Environmental Health
(714) 433-6419

California Health and Safety Code, Sections 5410-5416

- No person shall discharge raw or treated sewage or other waste in a manner that results in contamination, pollution or a nuisance.
- Any person who causes or permits a sewage discharge to any state waters:
  - must immediately notify the local health agency of the discharge.
  - shall reimburse the local health agency for services that protect the public's health and safety (water-contact receiving waters).
  - who fails to provide the required notice to the local health agency is guilty of a misdemeanor and shall be punished by a fine (between $500–$1,000) and/or imprisonment for less than one year.

Regional Water Quality Control Board
Santa Ana Region (951) 782-4130
San Diego Region (858) 467-2952

- Requires the prevention, mitigation, response to and reporting of sewage spills.

California Office of Emergency Services
(800) 852-7550

California Water Code, Article 4, Chapter 4, Sections 13268-13271
California Code of Regulations, Title 23, Division 3, Chapter 9.2, Article 2, Sections 2250-2260

- Any person who causes or permits sewage in excess of 1,000 gallons to be discharged to state waters **shall immediately notify the Office of Emergency Services.**
- Any person who fails to provide the notice required by this section is **guilty of a misdemeanor** and shall be punished by a fine (less than $20,000) and/or imprisonment for not more than one year.

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Sewage Spill
Reference Guide

Your Responsibilities as a Private Property Owner

Residences
Businesses
Homeowner/Condominium Associations
Federal and State Complexes
Military Facilities

Orange County Sanitation District

Health Care Agency
Environmental Health

PROJECT Pollution PREVENTION
www.ocwatersheds.com

This brochure was designed courtesy of the Orange County Sanitation District (OCSD). For additional information, call (714) 962-2411, or visit their website at www.ocsd.com

What is a Sewage Spill?

Sewage spills occur when the wastewater being transported via underground pipes overflows through a manhole, cleanout or broken pipe. Sewage spills can cause health hazards, damage to homes and businesses, and threaten the environment, local waterways and beaches.

Common Causes of Sewage Spills

Grease builds up inside and eventually blocks sewer pipes. Grease gets into the sewer from food establishments, household drains, as well as from poorly maintained commercial grease traps and interceptors.

Structure problems caused by tree roots in the lines, broken/cracked pipes, missing or broken cleanout caps or undersized sewers can cause blockages.

Infiltration and inflow (I/I) impacts pipe capacity and is caused when groundwater or rainwater enters the sewer system through pipe defects and illegal connections.

You Are Responsible for a Sewage Spill Caused by a Blockage or Break in Your Sewer Lines!

Time is of the essence in dealing with sewage spills. You are required to **immediately**:

Control and minimize the spill. Keep spills contained on private property and out of gutters, storm drains and public waterways by shutting off or not using the water.

Use sandbags, dirt and/or plastic sheeting to prevent sewage from entering the storm drain system.

Clear the sewer blockage. Always wear gloves and wash your hands. It is recommended that a plumbing professional be called for clearing blockages and making necessary repairs.

Always notify your city sewer/public works department or public sewer district of sewage spills. If the spill enters the storm drains also notify the Health Care Agency. In addition, if it exceeds 1,000 gallons notify the Office of Emergency Services. Refer to the numbers listed in this brochure.

Overflowing cleanout pipe located on private property

You Could Be Liable

Allowing sewage from your home, business or property to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up and enforcement efforts. See Regulatory Codes & Fines section for pertinent codes and fines that apply.

What to Look For

Sewage spills can be a very noticeable gushing of water from a manhole or a slow water leak that may take time to be noticed. Don't dismiss unaccounted-for wet areas.

Look for:

- Drain backups inside the building.
- Wet ground and water leaking around manhole lids onto your street.
- Leaking water from cleanouts or outside drains.
- Unusual odorous wet areas: sidewalks, external walls or ground/landscape around a building.

Caution

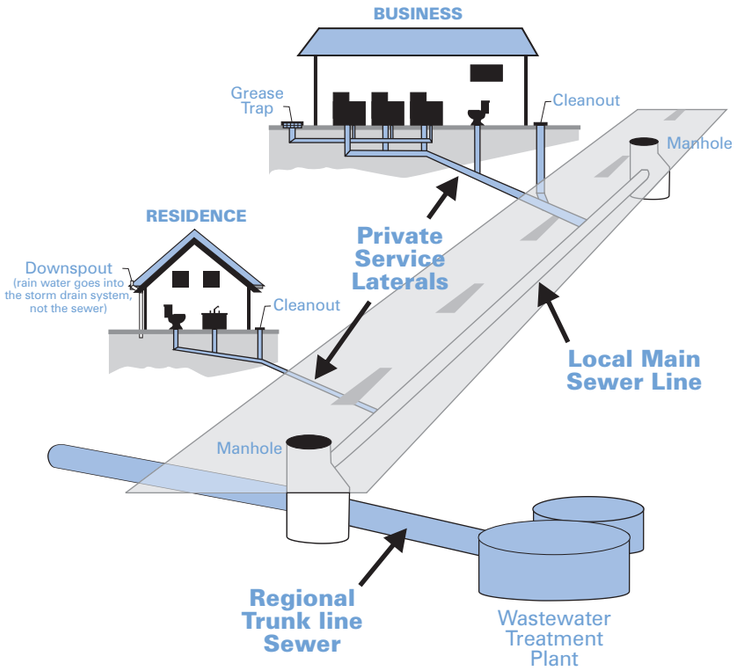
Keep people and pets away from the affected area. Untreated sewage has high levels of disease-causing viruses and bacteria. Call your local health care agency listed on the back for more information.

If You See a Sewage Spill Occurring, Notify Your City Sewer/Public Works Department or Public Sewer District IMMEDIATELY!

How a Sewer System Works

A property owner's sewer pipes are called service laterals and are connected to larger local main and regional trunk lines. Service laterals run from the connection at the home to the connection with the public sewer (including the area under the street). These laterals are the responsibility of the property owner and must be maintained by the property owner. Many city agencies have adopted ordinances requiring maintenance of service laterals. Check with your city sewer/local public works department for more information.

Operation and maintenance of **local and regional sewer lines** are the responsibility of the city sewer/public works departments and public sewer districts.



How You Can Prevent Sewage Spills

1. **Never put grease down garbage disposals, drains or toilets.**
2. **Perform periodic cleaning to eliminate grease, debris and roots in your service laterals.**
3. **Repair any structural problems in your sewer system and eliminate any rainwater infiltration/inflow leaks into your service laterals.**

Preventing Grease Blockages

The drain is not a dump! Recycle or dispose of grease properly and never pour grease down the drain.

Homeowners should mix fats, oils and grease with absorbent waste materials such as paper, coffee grounds, or kitty litter and place it in the trash. Wipe food scraps from plates and pans and dump them in the trash.

Restaurants and commercial food service establishments should always use "Kitchen Best Management Practices." These include:

- Collecting all cooking grease and liquid oil from pots, pans and fryers in covered grease containers for recycling.
- Scraping or dry-wiping excess food and grease from dishes, pots, pans and fryers into the trash.
- Installing drain screens on all kitchen drains.
- Having spill kits readily available for cleaning up spills.
- Properly maintaining grease traps or interceptors by having them serviced regularly. Check your local city codes.

Orange County Agency Responsibilites

- **City Sewer/Public Works Departments—** Responsible for protecting city property and streets, the local storm drain system, sewage collection system and other public areas.
- **Public Sewer/Sanitation District—** Responsible for collecting, treating and disposing of wastewater.
- **County of Orange Health Care Agency—** Responsible for protecting public health by closing ocean/bay waters and may close food-service businesses if a spill poses a threat to public health.
- **Regional Water Quality Control Boards—** Responsible for protecting State waters.
- **Orange County Stormwater Program—** Responsible for preventing harmful pollutants from being discharged or washed by stormwater runoff into the municipal storm drain system, creeks, bays and the ocean.

You Could Be Liable for Not Protecting the Environment

Local and state agencies have legal jurisdiction and enforcement authority to ensure that sewage spills are remedied.

They may respond and assist with containment, relieving pipe blockages, and/or clean-up of the sewage spill, especially if the spill is flowing into storm drains or onto public property.

A property owner may be charged for costs incurred by these agencies responding to spills from private properties.

Report Sewage Spills!

City Sewer/Public Works Departments

Aliso Viejo	(949) 425-2500
Anaheim	(714) 765-6860
Brea	(714) 990-7691
Buena Park	(714) 562-3655
Costa Mesa	(949) 645-8400
Cypress	(714) 229-6760
Dana Point	(949) 248-3562
Fountain Valley	(714) 593-4600
Fullerton	(714) 738-6897
Garden Grove	(714) 741-5375
Huntington Beach	(714) 536-5921
Irvine	(949) 453-5300
Laguna Beach	(949) 497-0765
Laguna Hills	(949) 707-2650
Laguna Niguel	(949) 362-4337
Laguna Woods	(949) 639-0500
La Habra	(562) 905-9792
Lake Forest	(949) 461-3480
La Palma	(714) 690-3310
Los Alamitos	(562) 431-3538
Mission Viejo	(949) 831-2500
Newport Beach	(949) 644-3011
Orange	(714) 532-6480
Orange County	(714) 567-6363
Placentia	(714) 993-8245
Rancho Santa Margarita	(949) 635-1800
San Clemente	(949) 366-1553
San Juan Capistrano	(949) 443-6363
Santa Ana	(714) 647-3380
Seal Beach	(562) 431-2527
Stanton	(714) 379-9222
Tustin	(714) 962-2411
Villa Park	(714) 998-1500
Westminster	(714) 893-3553
Yorba Linda	(714) 961-7170

Public Sewer/Water Districts

Costa Mesa Sanitary District	(714) 393-4433/ (949) 645-8400
El Toro Water District	(949) 837-0660
Emerald Bay Service District	(949) 494-8571
Garden Grove Sanitary District	(714) 741-5375
Irvine Ranch Water District	(949) 453-5300
Los Alamitos/Rossmoor Sewer District	(562) 431-2223
Midway City Sanitary District (Westminster)	(714) 893-3553
Moulton Niguel Water District	(949) 831-2500
Orange County Sanitation District	(714) 962-2411
Santa Margarita Water District	(949) 459-6420
South Coast Water District	(949) 499-4555
South Orange County Wastewater Authority	(949) 234-5400
Sunset Beach Sanitary District	(562) 493-9932
Trabuco Canyon Sanitary District	(949) 858-0277
Yorba Linda Water District	(714) 777-3018

Other Agencies

Orange County Health Care Agency	(714) 433-6419
Office of Emergency Services	(800) 852-7550

SEWER VS. STORM DRAIN

DO YOU KNOW THE DIFFERENCE?

Not all water in Orange County is treated the same…in fact, some water isn't treated at all. Rain and water from sprinklers and hoses wash litter, pet waste, motor oil, pesticides and other pollutants into the storm drain where it flows untreated into our creeks, rivers, bays and ultimately, our ocean. Only water that enters the sewer (from sinks and toilets) is treated before entering our waterways. SO DON'T TREAT THEM THE SAME.

PROJECT Pollution PREVENTION

www.ocwatersheds.com

Remember The Ocean Begins at Your Front Door

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, not properly disposing of used oil is illegal and can lead to fines. If you pour or drain oil onto driveways, sidewalks or streets, it can be washed into the storm drain.

Help prevent water pollution by taking your used oil and oil filters to a used oil collection center. Most major automotive maintenance centers will accept up to five gallons of used motor oil at no cost. For a list of locations, please visit www.cleanup.org.

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

For information about the proper disposal of household hazardous waste, call the **Household Waste Hotline** at **1-877-89-SPILL (1-877-897-7455)** or visit **www.oclandfills.com.**

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

RECYCLE USED OIL

emc/rev9/08

Help Prevent Ocean Pollution:

Tips for the Home Mechanic

PROJECT Pollution PREVENTION

The Ocean Begins at Your Front Door

Tips for the Home Mechanic

WORK SITE

- Locate the storm drains on or near your property. Do not allow used oil or any materials to flow into these drains.
- Examine your home for sources of pollution.
- Perform automotive projects under cover and in a controlled area to prevent stormwater runoff.
- Sweep or vacuum your automotive workspace regularly
- Use a damp mop to clean work areas. Never hose down surfaces into the street, gutter or storm drain.

- Pour mop water into a sink or toilet. Never dispose of water in a parking lot, street, gutter or storm drain.

PREVENT LEAKS AND SPILLS

- Keep absorbent materials such as rags and/or cat litter in the work area
- Empty drip pans into a labeled, seal container before they are full
- Wipe up any spills or repair leaks as they happen. Don't let them sit.
- Place large pans under any wrecked cars until all fluids are drained.
- Promptly dispose of collected fluids into a hazardous waste drum or deliver them to an oil recycling center. Used oil recycling locations can be found at http://www.ochealthinfo.com/regulatory/usedoil.htm

CLEANING SPILLS

- Clean up spills immediately by using absorbent material such as rags, cat litter or sand. If the material spilled is hazardous, dispose of the rag, litter or sand in the same manner as hazardous waste. If the material spill is non-hazardous, dispose of it in the trash.

- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at 1-877-89-SPILL (1-877-897-7455) or visit www.ocwatersheds.com to fill out an incident report.
- Report emergencies to 911.

VEHICLE FLUID MANAGEMENT

- Vehicle fluids are hazardous waste and must be stored and disposed of in accordance with all local, state and federal laws.
- Designate an area to drain vehicle fluids away from storm drains and sanitary drains.
- When possible, drain vehicle fluids indoors or within covered areas, and only over floors that are constructed of a non-porous material such as concrete. Asphalt and dirt floors absorb spilled or leaked fluids, making the cleanup extremely difficult.

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. Home improvement projects and work sites must be maintained to ensure that building materials 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 building materials into the ocean, so don't let them enter the storm drains. Follow these 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 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 while performing home improvement projects. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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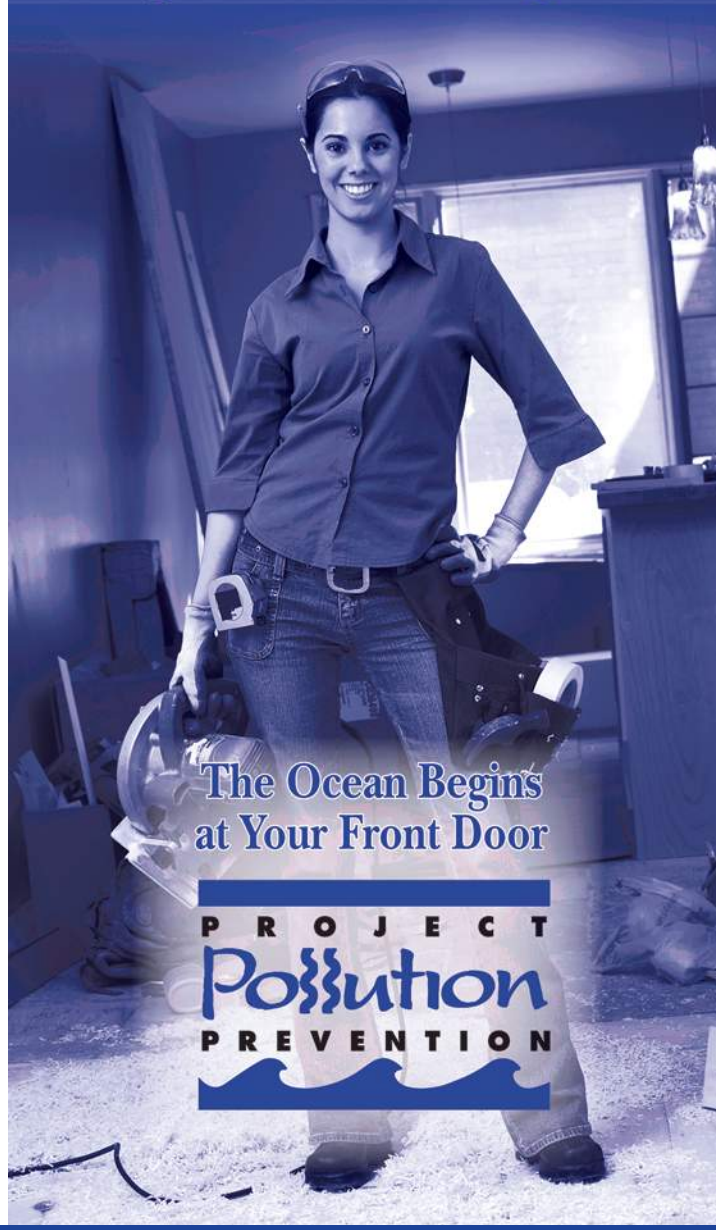
Help Prevent Ocean Pollution:

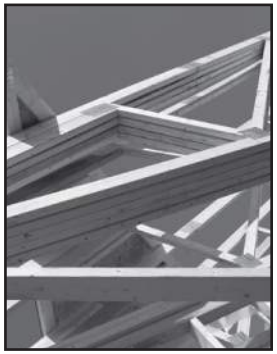
Tips for Home Improvement Projects



Tips for Home Improvement Projects

Home improvement projects can cause significant damage to the environment. Whether you hire a contractor or work on the house yourself, it is important to follow these simple tips while renovating, remodeling or improving your home:

General Construction



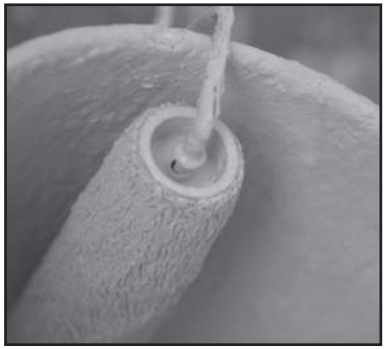
- Schedule projects for dry weather.
- Keep all construction debris away from the street, gutter and storm drain.
- Store materials under cover with temporary roofs or plastic sheets to eliminate or reduce the possibility that rainfall, runoff or wind will carry materials from the project site to the street, storm drain or adjacent properties.

Building Materials

- Never hose materials into a street, gutter or storm drain.
- Exposed piles of construction material should not be stored on the street or sidewalk.
- Minimize waste by ordering only the amount of materials needed to complete the job.
- Do not mix more fresh concrete than is needed for each project.
- Wash concrete mixers and equipment in a designated washout area where the water can flow into a containment area or onto dirt.
- Dispose of small amounts of dry excess materials in the trash. Powdery waste, such as dry concrete, must be properly contained within a box or bag prior to disposal. Call your local trash hauler for weight and size limits.

Paint

- Measure the room or object to be painted, then buy only the amount needed.
- Place the lid on firmly and store the paint can upside-down in a dry location away from the elements.
- Tools such as brushes, buckets and rags should never be washed where excess water can drain into the street, gutter or storm drain. All tools should be rinsed in a sink connected to the sanitary sewer.
- When disposing of paint, never put wet paint in the trash.
- Dispose of water-based paint by removing the lid and letting it dry in the can. Large amounts must be taken to a Household Hazardous Waste Collection Center (HHWCC).



- Oil-based paint is a household hazardous waste. All leftover paint should be taken to a HHWCC.
- For HHWCC locations and hours, call **(714) 834-6752** or visit **www.oclandfills.com**.

Erosion Control

- Schedule grading and excavation projects for dry weather.
- When temporarily removing soil, pile it in a contained, covered area where it cannot spill into the street, or obtain the required temporary encroachment or street closure permit and follow the conditions instructed by the permit.
- When permanently removing large quantities of soil, a disposal location must be found prior to excavation. Numerous businesses are available to handle disposal needs. For disposal options, visit **www.ciwmb.ca.gov/SWIS**.
- Prevent erosion by planting fast-growing annual and perennial grasses. They will shield and bind the soil.

Recycle

- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry (bricks, concrete, etc.), carpet, plastic, pipes (plastic, metal and clay), drywall, rocks, dirt and green waste.

- For a listing of construction and demolition recycling locations in your area, visit **www.ciwmb.ca.gov/recycle.**

Spills

- Clean up spills immediately by using an absorbent material such as cat litter, then sweep it up and dispose of it in the trash.
- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at **(714) 567-6363** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

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. Pet waste and pet care products can be washed into the storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never put pet waste or pet care 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

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 caring for your pet. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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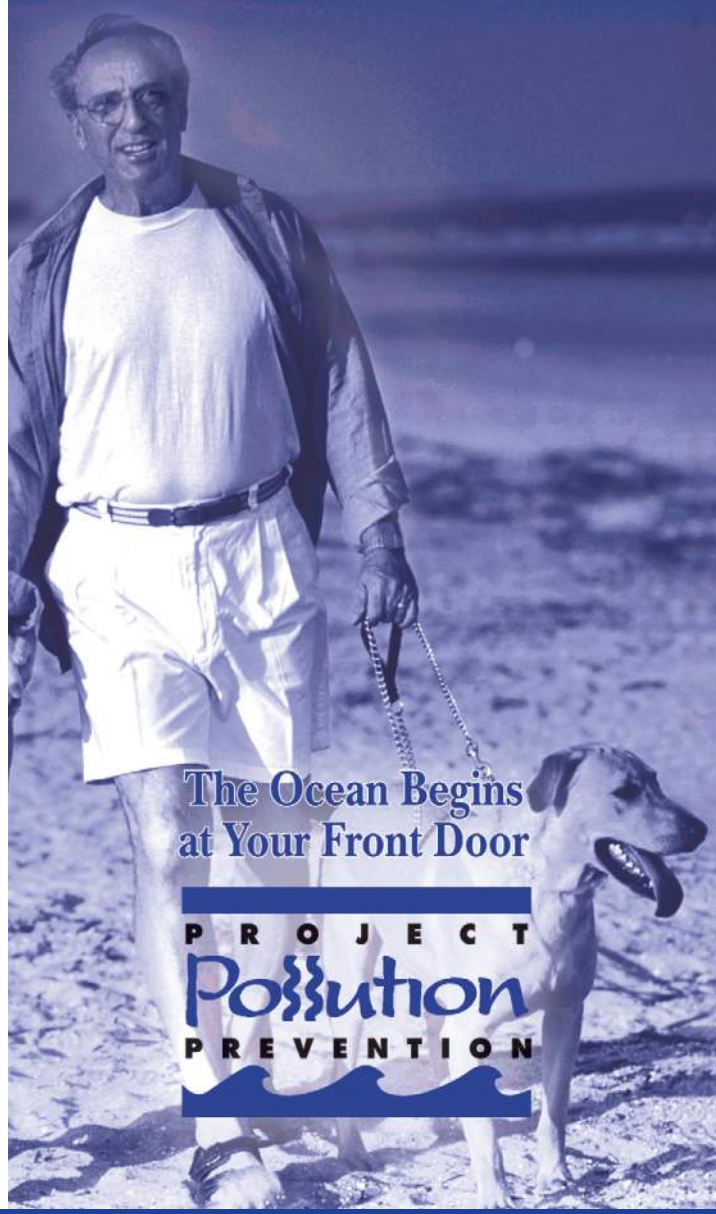
Help Prevent Ocean Pollution:

Tips for Pet Care



Tips for Pet Care

Never let any pet care products or washwater run off your yard and into the street, gutter or storm drain.

Washing Your Pets

Even biodegradable soaps and shampoos can be harmful to marine life and the environment.

- If possible, bathe your pets indoors using less-toxic shampoos or have your pet professionally groomed. Follow instructions on the products and clean up spills.

- If you bathe your pet outside, wash it on your lawn or another absorbent/ permeable surface to keep the washwater from running into the street, gutter or storm drain.

Flea Control

- Consider using oral or topical flea control products.

- If you use flea control products such as shampoos, sprays or collars, make sure to dispose of any unused products at a Household Hazardous Waste Collection Center. For location information, call **(714) 834-6752**.

Why You Should Pick Up After Your Pet

It's the law! Every city has an ordinance requiring you to pick up after your pet. Besides being a nuisance, pet waste can lead to water pollution, even if you live inland. During rainfall, pet waste left outdoors can wash into storm drains. This waste flows directly into our waterways and the ocean where it can harm human health, marine life and the environment.

As it decomposes, pet waste demands a high level of oxygen from water. This decomposition can contribute to killing marine life by reducing the amount of dissolved oxygen available to them.

Have fun with your pets, but please be a responsible pet owner by taking care of them and the environment.

- Take a bag with you on walks to pick up after your pet.

- Dispose of the waste in the trash or in a toilet.

PROJECT Pollution PREVENTION

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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

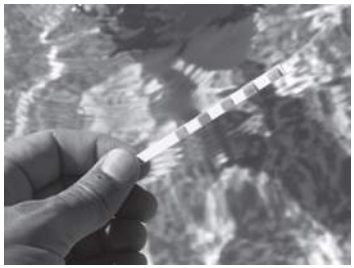
PROJECT Pollution PREVENTION

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.

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

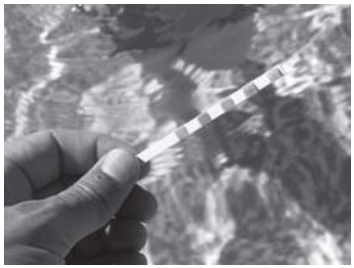
PROJECT Pollution PREVENTION

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, many common activities such as painting can lead to water pollution if you're not careful. Paint must be used, stored and disposed of properly to ensure that it does 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 paint 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 Problem Reporting Hotline
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For emergencies, dial 911.

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

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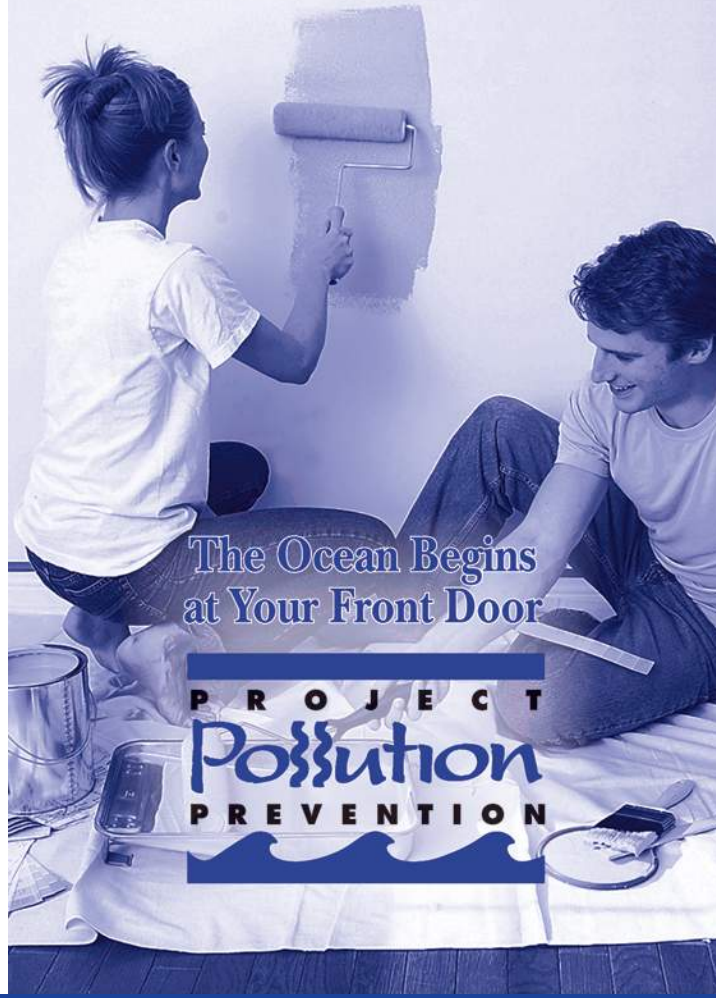
Help Prevent Ocean Pollution:

Tips for Projects Using Paint



Tips for Projects Using Paint

Paint can cause significant damage to our environment. Whether you hire a contractor or do it yourself, it is important to follow these simple tips when purchasing, using, cleaning, storing and disposing of paint.

Purchasing Paint

- Measure the room or object to be painted, then buy only the amount needed.
- Whenever possible, use water-based paint since it usually does not require hazardous solvents such as paint thinner for cleanup.

Painting

- Use only one brush or roller per color of paint to reduce the amount of water needed for cleaning.
- Place open paint containers or trays on a stable surface and in a position that is unlikely to spill.
- Always use a tarp under the area or object being painted to collect paint drips and contain spills.

Cleaning

- Never clean brushes or rinse paint containers in the street, gutter or storm drain.
- For oil-based products, use as much of the paint on the brushes as possible. Clean brushes with thinner. To reuse thinner, pour it through a fine filter (e.g. nylon, metal gauze or filter paper) to remove solids such as leftover traces of paint.
- For water-based products, use as much of the paint on the brushes as possible, then rinse in the sink.
- Collect all paint chips and dust. Chips and dust from marine paints or paints containing lead, mercury or tributyl tin are hazardous waste. Sweep up and dispose of at a Household Hazardous Waste Collection Center (HHWCC).

Storing Paint

- Store paint in a dry location away from the elements.
- Store leftover water-based paint, oil-based paint and solvents separately in original or clearly marked containers.
- Avoid storing paint cans directly on cement floors. The bottom of the can will rust much faster on cement.
- Place the lid on firmly and store the paint can upside-down to prevent air from entering. This will keep the paint usable longer. Oil-based paint is usable for up to 15 years. Water-based paint remains usable for up to 10 years.

Alternatives to Disposal

- Use excess paint to apply another coat, for touch-ups, or to paint a closet, garage, basement or attic.
- Give extra paint to friends or family. Extra paint can also be donated to a local theatre group, low-income housing program or school.
- Take extra paint to an exchange program such as the **"Stop & Swap"** that allows you to drop off or pick up partially used home care products free of charge. **"Stop & Swap"** programs are available at most HHWCCs.
- For HHWCC locations and hours, call **(714) 834-6752** or visit **www.oclandfills.com**.

Disposing of Paint

- Never put wet paint in the trash.

For water-based paint:

- If possible, brush the leftover paint on cardboard or newspaper. Otherwise, allow the paint to dry in the can with the lid off in a well-ventilated area protected from the elements, children and pets. Stirring the paint every few days will speed up the drying.
- Large quantities of extra paint should be taken to a HHWCC.
- Once dried, paint and painted surfaces may be disposed of in the trash. When setting a dried paint can out for trash collection, leave the lid off so the collector will see that the paint has dried.

For oil-based paint:

- Oil-based paint is a household hazardous waste. All leftover paint should be taken to a HHWCC.

Aerosol paint:

- Dispose of aerosol paint cans at a HHWCC.

Spills

- Never hose down pavement or other impermeable surfaces where paint has spilled.
- Clean up spills immediately by using an absorbent material such as cat litter. Cat litter used to clean water-based paint spills can be disposed of in the trash. When cleaning oil-based paint spills with cat litter, it must be taken to a HHWCC.
- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at **(714) 567-6363** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

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. 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
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www.ocwatersheds.com

To report a spill,
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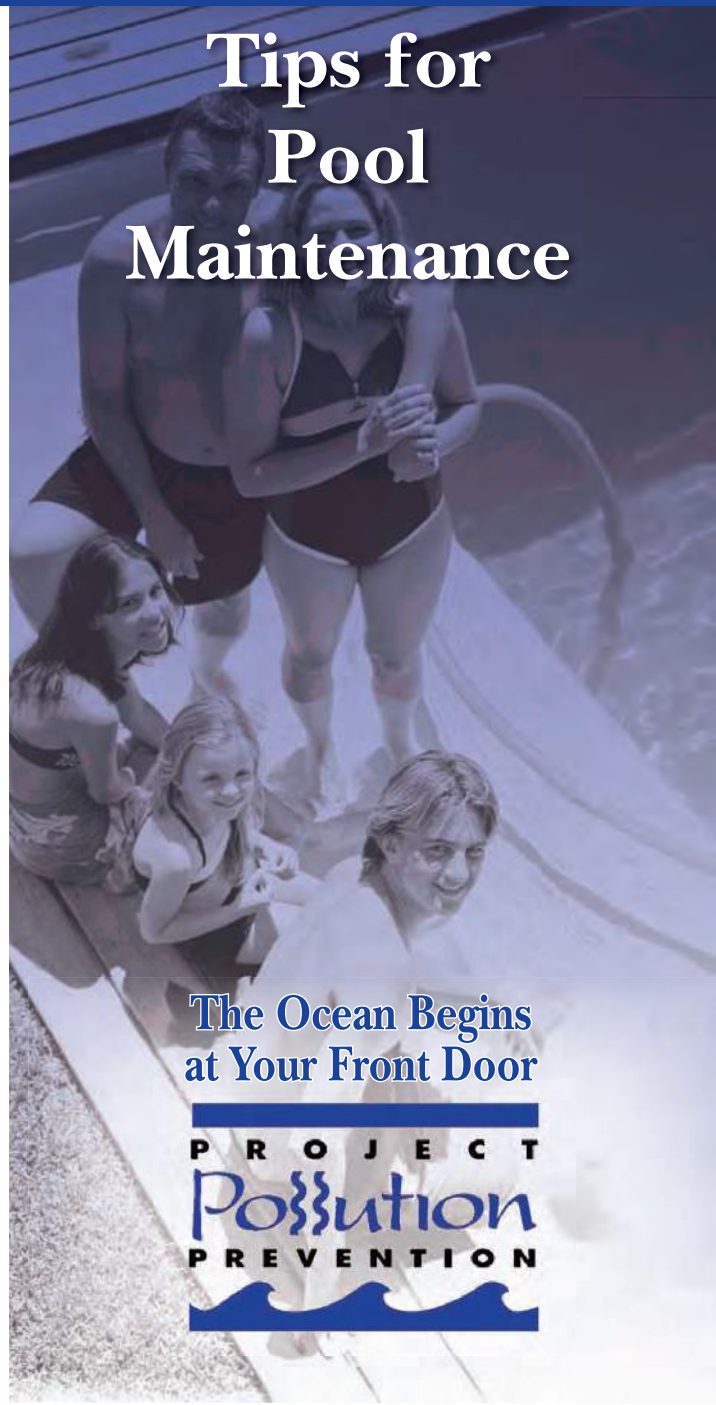
1-877-89-SPILL (1-877-897-7455).

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